Quickguide to Effective Injury Prevention
Saving Lives with Proactive Emergency Services

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DEDICATION

This is dedicated to every rescuer who lays their life on the line in the service of humanity; to New York's Bravest-who paid the ultimate price, saved thousands of people, and showed the world what it means to be one of us; to our loved ones-who keep us alive and sacrifice in so many ways; and to our partners-without whom, it can get mighty lonely out there.

ACKNOWLEDGEMENTS

I am writing this once again at the behest of Richard J. Smith III, M.S. (Chief, Injury/EMS Branch Maternal and Child Health Bureau, U.S. Department of Health and Human Services) and Jim Flaherty MD (Navajo Area EMS Medical Director and Indian Health Service/EMSC Program Coordinator). Both are good partners and a constant inspiration to me. Thanks also to Peter (Brother Pete) Decker for his steadfast assistance in the editing process and his constant good cheer. Lastly, I would like to acknowledge the mentorship of Leon Robertson PhD, Injury Epidemiologist and prolific author, who provides a moral and scientific compass from which I try my best not to stray. As always, my thanks and admiration goes out to you, gentlemen.

FOREWORD

There is an old story about the emergency-response team that was so busy picking up injured people at the bottom of a cliff that they did not have time to see how they were falling. Dave Short took the time to find out how people could be prevented from driving Over-the-Bank on a hundred-mile stretch of road in California. An average of two people per year are saved by the guardrails that were installed more than a decade ago as a result of his efforts.

In this powerfully written document, he outlines the principles that any EMS can use to reduce incidence and severity of injuries. While it takes time and effort, the payoff in the long run is time and resources saved by reducing numbers of EMS runs and medical care costs due to reduced severity of injury to those involved. It could also lengthen the professional life of emergency technicians who get closer to burnout every time a child is maimed or a patient is lost.

Injuries are not random events. They are concentrated in space, time and among certain populations. As Dave points out, something as simple as a pin map often reveals clusters that can be reduced by available, low-tech approaches. To achieve the reductions, someone must reveal the patterns and make them known to people in a position to change the situation. Emergency personnel are in a primary position to track the patterns.

Dave Short has been there and here tells you how to get the job done.

Leon S. Robertson, Ph.D.
Yale University (retired)

PREFACE

This is the first revision of the "Quick-Guide to Effective Injury Prevention, Saving Lives with Proactive Emergency Services". The original Quick-Guide was written for use by EMT's who serve Native American tribal communities. This version is for all rural and frontier emergency service providers. Rural and frontier EMS districts face many of the same difficulties and challenges that confront tribal EMTs.

I've spent almost 20 years during my EMS/Fire/Rescue career advocating proactive emergency services. I do this because of my own experience with fatal trauma. It took eight years of rural EMS experience, trying everything I could think of, to come to the realization that there were some things that I just could not fix with EMS, no matter how fast we were, how good, or how lucky. When Rick Smith *(see acknowledgements)* showed me a proactive way to do what we could not do with EMS alone, I jumped on it. Within two years, six hazards that were killing our people were eliminated, our worst fatal trauma problem disappeared, and multiple fatality events went from common to rare.

I have studied traumatic fatalities in this district since 1977. By statistical projection, during the 17 years since a total of one-half mile of guardrail was installed at our worst cluster sites, over 30 deaths have been prevented. Without the guardrails, these 30 people would have perished in gruesome rollover crashes, tumbling over and over down steep embankments to their deaths hundreds of feet below. Instead, they merely bounced off of guardrails. I'm happy with that.

In talking to EMTs about proactive EMS, I have found that one of their chief complaints has always been that injury prevention somehow steals thunder from the really important work of responding to emergencies. Nothing could be farther from the truth! **Proactive EMS is meant to enhance your emergency services, to do something that you currently cannot do, to save the trauma patients that you cannot save with EMS alone.** In essence you respond to a hazard that you know exists in your community, a hazard that you know will kill more people, and before it kills again, you eliminate it. As always the bottom line is saving lives, which makes this a perfect addition to your emergency services. EMS saves lives, with proactive EMS; you'll save more, perhaps many more.

Having done both many times, I can tell you it's much more rewarding to backboard a family out of a vehicle that has hit a guardrail which you've helped install then to rappel down an unprotected, high embankment to retrieve their bodies.

For trauma patients who are going to die no matter what we do, and some will, injury prevention and injury control can be very effective alternatives.

I sincerely hope that you will find something in these pages that will help you save the lives of some people that your EMS currently cannot help. If something in this text helps you to do that, I will have done my job.

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I. EMS PLUS PREVENTION: REACTIVE AND PROACTIVE STRATEGIES THAT WORK TOGETHER

WHAT IS "PROACTIVE EMS"?

Proactive EMS combines the resources of EMS with the strategies of injury prevention and injury control. EMS provides knowledgeable, professional people and patient care records that contain valuable clues about the causes of preventable traumatic events. Using these we can identify the preventable injuries and correct the hazards that cause them. Injury prevention and injury control provide effective strategies, scientifically proven to prevent injury events from happening, or to reduce the injuring energy exchange during the event in order to lessen the severity. As a team, EMS and injury prevention/injury control (IP/IC) are a natural combination that work together to eliminate some fatal injuries before they happen, and to provide EMS with less critical patients by reducing the severity of injuries. The result is a dramatic reduction in traumatic fatalities.

EMS is a "Downstream," reactive strategy: We wait for an injury event to occur somewhere upstream, and then we react to the situation that we find when we arrive, farther downstream. With EMS we attempt to prevent any further injury to the patient, to minimize the damage that has already been done, and to halt the progression of shock syndrome from destroying vital organs. Therefore EMS is truly injury control after the fact *(in the "post-injury phase")*.

EMS is designed to respond to, care for and transport injured patients that have some chance of survival. EMT's are responsible for saving many thousands of lives every year. However, we cannot save those who have no chance of survival, and we can only save some of those whose chances are poor or fair. Despite our best efforts, there are some patients who will not make it. Nobody likes to admit defeat when there's nothing to be done, and nobody likes to lose a patient we've tried hard to save, but it happens all the time.

Downstream strategies do not control the problem; they attempt to control the aftermath of the problem. The injury has to happen first and then we react to it as best we can. If the patient has already expired, or has received wounds that are not compatible with life, EMS will fail every time. If the patient is critically unstable, and their life is in the balance, then the many variables of that particular situation come into play. So basically the unstable patient is at the mercy of luck, our skill, and "God's grace in a long handled spoon." *(Thanks to my friend Doc Holliday Sr. for that useful piece of wisdom from my childhood.)* These patients must receive the very best care from the time EMS arrives until they completely stabilize, or they won't make it. Out in the country, this can be a very long time. There are potential pitfalls that are completely out of the EMT's control all along the way. Even after the patient reaches surgery, their life depends on God's grace for a long time.

Reactive strategies are complex and require a lot of manpower. They are also very expensive to improve. While it may be possible to upgrade your EMS, put on more personnel, open up bases in the outlying parts of the district, improve the local hospital's treatment of critical pediatric trauma, establish on call surgery, etc., these improvements will still not save any people who are already dead, and they will only save some of those who are unstable.

INJURY PREVENTION and INJURY CONTROL: PROACTIVE STRATEGIES

"Recognition of the recurring patterns that cause fatal injuries give us clues to strategies that may prevent the injury event from happening (injury prevention), or control the amount of damage caused by the event, without reducing the incidence (injury control)." (Robertson, 1992)

Injury prevention and injury control are proactive or "Upstream" strategies:
Injuries that recur in the same place, under the same circumstances, and among the same population are often the result of an identifiable hazard. Injury prevention is a process of seeking out these hazards and eliminating them. Injury prevention takes place in the "upstream," or "pre-injury phase" before the injury event occurs. A hazard is identified and removed or modified in order to prevent any further injurious events from happening there. Re-engineering a deceptive turn in the road, removing a fixed object along the highway, and lighting a dark area in a residential zone that has a high incidence of night time auto vs. pedestrian fatalities are all examples of effective injury prevention. The modification removes the hazard and therefore prevents all future injury events from occurring at that location.

An excellent example of the effectiveness of injury prevention is childhood poisoning by medication. *"An especially steep decline in childhood poisoning death rates occurred after childproof packaging was required on all drugs and medications beginning in 1973. The 50 percent decrease in poisoning by all drugs and medications in the first three years (1973-1976) was substantially greater than the decrease in poisonings by other solids and liquids, most of which were not required to be packaged in childproof containers…. During 1968-1979, the period analyzed for most causes of death in this book, the* ***80 percent decline in poisoning death rates*** *(emphasis added) for children ages 1-4 exceeded that for any other major cause of childhood injury death." (*Haddon, W. Jr. 1984. *Forward to the Injury Fact Book, First Edition)*

Injury control occurs during the actual injury event itself. Some environmental modification is made before the injury event that increases the protection to the patient during the event. Air bags are a good example of injury control. Just as many front-end collisions occur, but fewer result in fatal injuries because the air bags cushion the occupants during the crash.

Many injury control modifications have been made to vehicles over the years that have reduced the number of fatalities in motor vehicle crashes dramatically. Collapsible steering columns, padded dashboards, and safety glass are all mandatory injury control improvements that have been introduced into legislation by injury researchers. Prior to that time, being impaled on the steering column, crushing your legs and torso on the dashboard, and being beheaded by the windshield was a common occurrence in otherwise survivable crashes. From 1966 to 1970 the National Highway Traffic Safety Administration, directed by William Haddon Jr. M.D, spearheaded these and other legislated injury control modifications to motor vehicles. These modifications have been directly responsible for a vast reduction in motor vehicle crash deaths. Even the most conservative estimate of 10,000 lives saved per year works out to a handy sum of about 250,000 people saved to date because of these improvements in the crashworthiness and more forgiving interior surfaces of passenger vehicles. Dr. Haddon went on to serve as the President of the Insurance Institute for Highway Safety from 1969 until his death in 1985. That institute continues to carry on the great tradition begun by Dr. Haddon by performing yearly crash worthiness testing on all new vehicles. You may be familiar with their testing from their reports and yearly television specials. For more information you may visit their web site at: **http://www.hwysafety.org/**

II. ENVIRONMENTAL INTERVENTIONS: WHY THEY OFTEN WORK BEST

The most important point to be made about interventions is that whenever possible the intervention that you plan to use should be environmentally based. An environmental intervention is based on identifying and modifying or removing a specific hazard so that no further injury event will occur, or the event that does occur will not release enough damaging energy into the patient to cause a fatal injury. Environmental interventions are highly effective for specific hazards, they cost comparatively little and they require no action on the part of the person to be protected. Childproof packaging of medication is one example of an environmental intervention. Crushable containers filled with water or sand around fixed objects on freeways is another.

Research has shown that the people who are most at-risk of fatal trauma are often the very people who are least likely to change their behavior, even when they understand the risks. Therefore, educational strategies, which require behavioral change, decision-making and frequent effort, are the least likely to result in protective changes among the highest-risk groups.

"Failure to use automobile seat belts, for example, has been shown to be especially common among those at greatest risk of being involved in crashes, such as teenagers, alcohol-impaired drivers, people traveling at night, drivers who follow other cars too closely or ignore red traffic lights, and people in low income areas. Thus the groups at risk are often those whose behavior is the most difficult to change. If injuries among the people at greatest risk are to be reduced, the difficulty of changing their behavior must be taken into account in planning effective approaches. Virtually all available evidence indicates that, for injuries as for diseases, the most effective way to protect high-risk groups as well as the rest of the population is with measures – such as pasteurizations and household fuses – that do not require individual motivation and frequent effort." (Baker, 1992).

EMS AND EDUCATIONAL INJURY PREVENTION EFFORTS:
EMT's have spent many years voluntarily providing educational injury prevention and this is to be commended, but education in itself is not always the most effective approach. By adding a proactive EMS component, three different strategies become one... education/behavioral for young children who will hopefully influence their parents, environmental strategies for the high-risk group who does not always respond to education, and EMS for the injured.

Since EMS is in the business of caring for injured people, teaching the public how to avoid injury is a natural and useful thing for us to do. It reaches out into the community and encourages interaction between the local population and their emergency services. Child safety-seat programs, 911 awareness, public service announcements, CPR classes, Sober-Grad, Stop-Drop-and-Roll, and safety belt programs all have contributed to reduced rates of trauma deaths throughout the United States. I encourage you to continue performing this valuable service to your community. All public safety agencies that have voluntarily responded in support of these and other educational projects deserve commendation for them.

Occasionally we will be contacted by a mother who saved her child with the Heimlich maneuver, or we will hear of a child who dialed 911 and saved his unconscious mother. This is direct evidence that what we do with education saves people. But these events are rare and we don't get that kind of positive feedback very often. **Education targets a large audience in hopes that the message will result in protective behavior that may save a few.**

BEYOND EDUCATIONAL INJURY PREVENTION:
Many EMT's I've spoken to over the years have said, "We do injury prevention already". This is true, but not the whole picture. Linda Ford, former director of Cherokee Nation EMS, and former president of the National Native American EMS Association probably said it more accurately when she said, to Rick Smith, *(see acknowledgements)* **"We do injury prevention, but we don't do what you do."**

By expanding your current injury prevention efforts to include targeting specific hazards, you not only know you are helping, you can see the results in reduced deaths year after year. You will see a complete cessation of fatal events where they once were common. **With proactive EMS we target the few hazards we know to exist in order to protect everyone.**

III. INVESTIGATING TRAUMATIC MOTOR VEHICLE CRASH FATALITIES: A GOOD PLACE TO START

WHY FOCUS ON MOTOR VEHICLE CRASH FATALITIES?

Simplify your job: Focusing first on fatal trauma saves time and reduces complications. Of your total EMS reports, probably less than five percent are fatalities. Of these, only a small percentage is traumatic. Collecting, sorting and investigating traumatic fatalities involve much less work and time than going through all the non-fatal reports.

When EMS doesn't work, prevention may be the answer: There are many reasons that people don't survive any traumatic event, some can be addressed with improved EMS, most cannot. Where EMS fails, prevention may succeed. Proactive EMS gives you a new and powerful tool to prevent unnecessary traumatic death.

Start with the worst problems first: A recurring pattern of fatal traumatic events indicates that a hazard exists that will continue to kill people until someone does something about it. Think of it as making the scene safe on a bigger scale.

Motor vehicle crashes often have a specific cause that can be targeted: Road hazards are frequently the cause of fatal motor vehicle crashes. These hazards can be identified and fixed. Intentional injuries such as homicides and suicides combined are now more prevalent than deaths by motor vehicle crashes, but they are complex events that tend to be more behavior related and less likely to have a specific identifiable hazard associated with them. So far the most clearly identifiable factor in intentional injuries is the availability of a gun.

Fatal motor vehicle crashes are well documented: The Highway Patrol, Coroner, and Department Of Transportation have thorough records on every motor vehicle fatality. This assures that there are plenty of alternate information sources and additional data sets available. You will need at least one matching data set to validate your findings.

People remember fatalities: Interviewing bystanders, locals, responders and crewmembers are easier when people clearly remember the situation. Where were you on 9/11/01?

Fatal motor vehicle trauma is often associated with severe injuries to other survivors: Often when you identify an area where fatalities cluster or a pattern, you may find many people with critical injuries from the same incidents. These include passengers in a death car, people in other vehicles who are caught in the event, children, parents and friends of the dead. Preventing fatal trauma reduces or eliminates all the associated critical injuries as well.

IV. FATAL TRAUMA: WHERE EMS FAILS, PREVENTION MAY SUCCEED

WHY COULDN'T WE SAVE THEM?

The following reasons apply to all rural and frontier EMS programs. Some are also common to urban programs:

- **The patients are DOS *(Dead on Scene)* before EMS arrives:** There is a predictable percentage of all trauma patients whose injuries are so severe that, "If they had been injured on the doorstep of a Trauma Center, they still would have died." If you review your EMS records for five years and identify these patients, you can accurately estimate how many more will die over the next five years, and the next. Until you prevent these fatal events from occurring, this pattern will continue indefinitely. EMS alone will never save any of these people.
- **Expired in the ambulance, the injuries were incompatible with life:** Some rural trauma patients who receive the very best care don't make it to the hospital due to uncontrollable complications *(internal hemorrhage, uncontrollable airway, etc.)* Prevention is the only way to save these patients.

- **Unrecoverable shock had set in:** These patients may survive in an urban area, but expire in rural districts due to extended response and transport times. Prevention will save many of these patients; EMS won't save any.
- **Mistakes and limitations of the available emergency services:** These patients could have survived to the hospital, but the available emergency services just could not handle them. *(The ambulance crew was out of position, inadequate back up, lack of advanced care for critical pediatric patients, inadequate specialized equipment, etc.)* Prevention will save many of these people; training and upgrading of emergency services will save some.
- **Expired in the Emergency department:** These patients arrive at the receiving hospital with some vital signs, but expire in the emergency department due to many variables that are beyond the control of field EMS. This group includes pediatric trauma patients who require specialized care and equipment not commonly available at rural primary care facilities. Also included are trauma patients who self admit to the emergency department, bypassing field EMS entirely. Prevention will save many; upgrading EMS will save a few. Patients who self admit can only be helped by prevention or improving the hospital's emergency services.
- **Expired in ER due to delays:** Any unstable patient who arrives in an emergency room, far from emergency surgery is in a holding pattern. Every delay in the notification or response of med-evac resources reduces the patient's chance of survival. This is primarily a policy issue. Review your policies and procedures manual to see if there is any way to reduce the amount of time between the injury and the patient's arrival at surgical care.
- **Expired enroute to surgical care:** With extended response times from urban Medical air-evac services and long flight times to trauma centers, unstable patients sometimes destabilize in flight and expire between the primary receiving hospital and surgical care. Even with immediate notification of flight resources, response and transport times are commonly over 2 hours. Pediatric trauma patients are especially vulnerable due to their tendency to rapidly decompensate in shock and the lack of on-call pediatric services at most rural hospitals. There are also fewer Level-I *(Pediatric)* trauma centers with resultant lengthened response and transport times. Injury prevention will save many of these young patients. Developing protocols for launching and utilizing air resources, pre-designated landing zones, and notifying trauma surgery as soon as possible will reduce delays and improve patient survivability. *(See chapter XII: Speeding up Trauma and Pediatric Emergency Care on the EMS Frontier.)*
- **Expired during or after surgery:** Those critical patients who, for whatever reasons, have beaten the odds and made it into surgery, can still expire afterward for many reasons, some preventable and some not. Prevention will save many, upgraded EMS, establishment of local trauma teams and quicker air-evac with faster transport to definitive care will also help, by delivering more stable patients to surgery.

The sad fact is, after all the good efforts of many professionals and endless expenditure of money, resources and time, people will die. Barring vast additional expenditures, there is currently little that rural EMS can do for the already dead and the dying except offer comfort to the patient and their families. Their lives are literally, "In God's hands".

Because this text deals primarily with fatal trauma, I will not dwell on the many patients who do survive, recover and live in a coma, can no longer think or act for themselves, who live in excruciating pain, or who have lost essential bodily functions. These people are the most expensive, resource consuming and arguably the saddest group of all. As we constantly push the threshold of death back, some patients benefit and some do not. Preventing fatal traumatic events will prevent a lot of associated suffering people. Upgrading EMS will improve the prognosis of only some of those that survive.

V. THE VALUE OF EMS RECORDS: FINDING CLUSTERS OF INJURY DEATHS

WHAT IS A CLUSTER SITE?

Cluster sites are areas or specific locations where a particular type of trauma call happens repeatedly. For example, there may be a single tree that has been hit several times and caused fatalities, or a particular curve where semi-trucks tip over. It may be a stretch of public beach where young men drown, or a residential district where auto vs. pedestrian fatalities occur to elderly people.

Any time similar, fatal events occur repeatedly at a particular location or area chances are good that you have a cluster site. When fatalities occur repeatedly under similar circumstances or within a particular population, they give clues to the root cause(s) of the fatal events. With this information, you know where the problem is, under what circumstances it occurs, and who it's happening to. You can then begin zero in on the hazard(s) and proceed to plan the best strategy to eliminate the problem.

The different features and uses of an area determine the types of hazards that will exist there. Increased speed is a contributing factor in the severity of all types of motor vehicle crashes. Fatality rates for auto vs. pedestrian crashes at 55 mph or more are nine times higher than they are for crashes that occur at 30 mph or less. A residential district where young people play or walk adjacent to an unlighted highway has an increased potential for nighttime auto vs. pedestrian fatalities. A downhill slope with a sharp curve and narrow shoulders will cause a higher incidence of roll over and run off road crashes. A two lane highway with uncontrolled intersections or driveway entrances along the roadway increase the chances for rear end, turning, or broadside auto vs. auto collisions. Unprotected bodies of water along the road increase the chances of submerged vehicle entrapments. Cigarette smoking in the home is the greatest single risk factor for fatal house fires and results in a 28% increase in death. Residences with wood heat are approximately 15% more likely to have fatal house fires. It's not surprising that rural America, which has all these issues, has an increased per-capita incidence of traumatic fatality.

Clusters of motor vehicle fatalities: In most communities, there are a few identifiable areas of the roads that are over-represented for crashes of a particular type and severity. Commonly known as "Dead man's curve", or "Blood alley" these are areas that have some feature that is causing people to lose control of their vehicles more often than elsewhere on the same road, or that increases the lethality of any crash that occurs there. The reasons for this may be as simple as inadequate signage or lighting, a deceptively sharp turn following a long straight stretch, or a tree immediately adjacent to a curve. For whatever reason, certain parts of the roadway are much more likely to cause a fatal crash than the rest of the road.

Responding to more than one fatality at the same site under similar conditions is often the first tip off. Think back over the fatal car crashes you've been on. Are there any that recur at a particular location? Ask your crewmembers if they can think of any. Often it's easy to identify cluster sites before going back through the records to confirm them. If you've been around the area for a while, you probably already know of at least one. When an emergency worker has been to two or three fatal incidents at one particular spot, and when the same scenario is present each time, it's not hard to identify a cluster site. None of this is rocket science, it's very simple to gather the records together for a known cluster site, investigate the events and find the one factor that can be modified or removed that will protect the entire population at risk. The only requirements are accuracy, completeness, and matching your data set with at least one other to confirm the findings.

Emergency responders are in a unique position to know where these dangerous areas are and the types of incidents that happen there. We also understand the cost in human suffering

and grief caused by them. Because of this, EMTs are the perfect people to call these hazards to the attention of the agencies responsible, in order to get them eliminated. We have the specifics, and we also understand the reality of leaving things as they are. That is not the kind of knowledge you get from books.

AN EXAMPLE OF FATAL MOTOR VEHICLE CRASH CLUSTERING AND HOW EMS HELPED SOLVE THE PROBLEM:

Hoopa EMS and fatal Over-the-Bank cluster sites: During the 1970's and early 80's in the Hoopa EMS district of Northern California, experience taught us that during the first rains of the wet season, accumulated oils would rise to the surface on the highways *(circumstances)* and vehicles would skid off the road at certain curves (*cluster sites),* bounce over old rotten logs *(no longer effective barriers)* that had been placed along the roadway many years ago. The vehicles would then hurtle over the logs and tumble down very high and steep embankments *(fatal hazards),* sometimes into the rivers far below. Multiple fatalities in the crash vehicle were fairly common. We knew that any of these crashes occurring at any of the cluster sites, which were narrower, higher and steeper than other areas of the district, would probably result in death. In our area we called this type of crash an "Over-the-Bank," or OTB for short.

Even before the incidents occurred, and before we gathered any data on OTBs we knew where they were likely to happen *(Local highways at OTB cluster sites: Steep, high bluff areas with very little or no shoulders protected by ineffective log barriers)* to whom *(local highway users)* and when *(first rains).* OTBs were such a common occurrence that when the first rains came, we would call in extra personnel, run a thorough check out and maintain all the rescue gear, train on OTB scenarios, and wait anxiously for the calls to come. They usually did. We were quite good at quickly accessing and bringing the patients up the bank. Even when they were unstable and required advanced life support before rescue, we could run a full code on the patient at the bottom of the embankment, secure them in the stokes litter, and bring them up the cliff on a winch cable over 300 feet in less than an hour utilizing a total of three or four personnel to do it. Nevertheless, the efficient and aggressive EMS didn't often save anyone's life. Multiple system trauma and massive internal injuries were common and usually too severe to withstand transport times in excess of an hour.

Obviously we weren't the first people to figure out where fatal OTBs were happening. The old log barriers were along the roadway precisely at most of the cluster sites we identified. At one time, the large fir logs served as effective barriers to vehicles leaving the roadway, but by the late 70's they'd rotted down to a thickness of less than a foot in many places. This is one good reason that ongoing surveillance is so important; things change.

In 1983 I documented six OTB fatality cluster-sites; most were obvious (as some of yours probably are). These six sites accounted for almost all of our fatal Over-the-Bank crashes. In 1985, a total of one-half mile of custom designed guardrail was installed by the California Department of Transportation at those sites. *(There was a problem with installation at most sites because they were so steep and narrow that there was no shoulder to anchor guardrails to.)* In 1984, engineers in Eureka, California Dept. of Transportation developed a new guardrail system specifically for this problem. They later received an award for engineering excellence for this innovative design. *(This new guardrail system was anchored on steel beams buried in trenches deep beneath the roadbed and cantilevered out to the edge.)* As soon as the guardrails were in place, our Over-the-Bank, and multiple fatality problems disappeared.

That was 17 years ago. In 1996 I re-evaluated the effectiveness of the guardrail system by looking at all the fatalities from OTB crashes from the year 1977, *(when I first started working in Willow Creek and Hoopa),* until 1985, *(the year the guardrails were installed).* I compared the OTB fatalities that occurred from 1977-1985 to the OTB fatalities that occurred from 1986 to 1996 *(after the installation)*. I was interested to find the difference in the incidence of deaths. I also was concerned that by keeping people on the roads instead of allowing them to go Over-the-

Bank, there would be an increased incidence of fatalities from hitting the rails themselves, or perhaps form bouncing back across the center-line and hitting other vehicles.

Statistically, without improvement, approximately 26 people would have died in Over-the-Banks at those six sites within 10 years. Instead there were zero OTB fatalities at those sites.

Happily, there were also zero fatal auto vs. auto crashes involving vehicles that were kept on the roadway by the guardrails, and zero fatalities as a result of vehicles hitting the guardrails themselves. In addition, there were only two multiple fatality crashes in the entire ten-year period with a total of four people killed. One of these was near an improved site but the fatality was coincidental; the protections were not involved in any way. The other was far from any cluster site.

VI. 13 STEPS TO ELIMINATE PREDICTABLE DEATHS IN YOUR COMMUNITY

1. DECIDE TO TAKE ACTION:
This is the most important step of all. Surveillance and documentation alone will not save anyone. Many researchers fall into the trap of "studying the problem to death". In this case, if you don't take action, you may literally "study it to someone else's death". When you identify a fatal injury problem in your community, doing nothing is akin to not responding. **Make up your mind when you start that when you finish, you will take action on your findings that will result in an effective intervention.**

2. SELECT A PRIMARY DATA SOURCE:
The records kept by your EMS program may be sufficient, but often they are missing some important data. If you cannot clearly establish what happened or exactly where, you may be able to get that information from other local responders. Local people may also be able to help you by remembering details of events and they can refer you to other people with information. Take notes.

Useful primary data should contain the following information:

- Date
- Time
- Exact location
- Type of event
- Dispatch information
- Patient identifiers
- Mechanism of injury
- Observable injuries
- Treatment rendered
- Patient's response to treatment
- Date of death
- Probable cause of death

3. LOOK AT THE RECORDS OF FATALITIES AND SORT THEM BY CAUSE:
Sort fatality records into piles based on the primary cause of injury (motor vehicle crash, violence, suicide, etc.) As you sort, pay special attention to any identical matches within each pile. Once you have the records broken into primary cause of injury, review each pile for similarities.

- Make copies of each fatality report to use in your investigation. These are your working database
- Tag all original fatality reports for future reference
- File the originals for safekeeping

- Make piles of charts for crashes that occur in the same location. *(Suspected cluster sites)* Watch closely for cluster sites. If you find any, make a separate file just for them
- When you find obvious matches, mark them for future reference and keep them together
- Select the piles that have obvious similarities *(particularly if they occur at the same site)* for further investigation
- By the time you have gone through your primary fatality data two or three times, you should have a very good idea of where fatal events are occurring and some ideas on why they happen there. Remember, cluster sites are where you have the best chance of making a significant improvement, so always watch for them.

4. IDENTIFY A SECOND MATCHING DATA SOURCE:

Matching data sources add power and accuracy to your research. Every research project benefits from corroborating evidence. There are many possible additional sources of data that can be matched to your reports that will enhance your understanding of the events and add strength to your contention that something must be done to correct the hazards you find.

A good secondary data source will be accessible, relative to your district and have additional information specific to the injury problems you have identified in your primary data source. It will provide you with all the necessary information that your primary reports do not contain. Compare the different sources to find the reports that provide the most relevant information that is missing from your primary database. When you have selected a second source, obtain matching reports for the particular site or injury event that you are interested in. Clip the matching reports together and keep them together to avoid double counting. One good matching data set is usually sufficient, but when relevant and easily obtained, more is better.

SOME OF THE BEST LOCAL DATA SOURCES:

Contact your local Department of Transportation (DOT) and the Highway Patrol. **The DOT keeps records of every collision that happens on the State roadways.** They will usually provide you with a big computer print out of the specific stretch of road you want to look at. The printout has lots of information that is useful to establish exactly what happened. Unfortunately the DOT may purge their records after five years or so, so the sooner you get the reports, the better!

The Highway Patrol will probably provide you with copies of their own investigations for a nominal copying fee. In California it costs $5.00 per report and you must provide them with precise information that identifies the reports you want. This is money well spent, because Highway Patrol reports will contain a thorough investigation of direction of travel, skid marks, speed, percipient cause, what was hit, tire wear, alcohol use, etc. In addition, the report will probably have a sketch of the scene with skid marks, position of the vehicle, exact location on the highway etc. It saves a lot of time to have a professional reenactment of the crashes in your hand when you go to the site.

The County coroner or medical examiner will have records of every death occurring within the county by date and name of deceased. You can usually review their records and make notes or copies that establish time and cause of death and next of kin, *(in case you wish to interview them as witnesses or in order to gain some support for your efforts).* Going through death certificates, you may find a few patients who were alive when they arrived at the hospital and died later. In these cases, it is generally accepted that if they expire within 30 days of the injury event, the event itself was the principal cause of the death.

The local library also usually has large microfiche files of local newspapers that provide additional information along with analysis. The advantage to using the newspaper clippings is that they often can be traced back farther than other data sources. Once you know where something is happening, simply scan backwards in time from your first record and find other similar events at the same site. Some microfiche viewers also have a copy function so you can print out any items of interest.

Good secondary data sources include:

- Highway Patrol and local police reports
- Local emergency services agencies
- State Department of Transportation motor vehicle crash statistics reports
- Coroner and Medical Examiner
- Dispatch logs
- Local newspapers, especially if they accurately quote Highway Patrol and police reports.
- Emergency room and hospital records.
- The Indian Health Service's Injury Prevention-Severe Injury Surveillance System database
- State Office of Vital Statistics
- National Highway Transportation Safety Administration (NHTSA)/Fatal Analysis Reporting System (FARS)

Match documents from your secondary data source(s) with your EMS charts. Review all these documents. Select the ones that have the most information that is relevant to your study. Look for similarities and discrepancies. Look for patterns between charts. If you can't find a pattern that repeats in a specific location, try making piles of records based on the cause of the injury *(rollover, head-on, etc.).* Attach each primary report to its matching secondary report. Keep the records together.

A secondary data source for a fatal MVC investigation must include information on environmental, vehicular, and human factors that caused the crash or aggravated the injuries such as:

- Exact location of the event
- Roadway description including grade, curvature etc.
- Road surface at the time of the crash: Wet, icy, dry, etc.
- Weather
- Visibility
- Direction of travel
- Type of crash: Angle, frontal, side, rollover, fixed object, immersion, etc.
- Ejection
- Speed of travel
- Alcohol present
- Safety equipment used
- Events leading to the crash
- Cause of fatal injuries
- Drawings of the crash and the scene

5. COMPARE BOTH DATA SETS AND IDENTIFY CLUSTER SITES:
Compare the piles of fatal reports that are related to specific locations. Which pile has the most reports? Obviously the biggest pile represents an area with a lot of fatal incidents. Start with the biggest piles and begin the investigative work. Look for patterns that repeat from incident to incident at each site.

6. NARROW DOWN THE SEARCH AND DEFINE THE EXACT NATURE OF THE PROBLEM:
Most of the rest of the job so far has been to prepare you for the real investigation, and this is where it begins. This is the really interesting and productive part. Detective work is a process of gathering and comparing evidence and looking for patterns. Injury Epidemiology works exactly the same way. Below are some of the more common clues to watch for as you begin your investigation.

Are fatal incidents related to particular location? Where?

- Intersection
- Unlit residential area
- Curve *("Deadman's Curve")*
- Milepost marker
- Prominent land feature
- Particular stretch of highway *("Blood alley")*
- Community or neighborhood
- Embankment, cliff, ditch or body of water
- Public swimming hole or diving area
- Tree, pole, fixed object
- Near a bar *("The Knife and Gun Club")*

Does a particular time of day or night have an unusually high death rate? When? Why then?

- After dark
- Noon
- Rush hour
- Bar break

Is there a particular population or age group affected? Who?

- Young males
- Females
- Elderly
- Bar patrons
- Young children
- Particular ethnic group
- Gang members

Is there a particular behavior or social situation that predisposes a certain type of injury event? What is it and why?

- **All fatal injuries:** Alcohol and drug abuse, guns, peer pressure, binge drinking, DUI, poverty, anger, risky behavior, depression, isolation
- **Motor vehicle collisions:** Speeding, DUI, fast cars and motorcycles, racing, falling asleep, failure to use safety belts, unsafe passing, risk taking
- **Drowning:** Swimming/boating, children ages one to four and unfenced-residential pools, infants unsupervised in the bath, hot tubs, cold and swift water, muddy or murky water in ponds and lakes, attractive nuisances off shore, failure to use floatation devices, no lifeguards, open five gallon buckets, vehicles fording flooded roads, alcohol.
- **Assaults:** Bar fights, alcohol and drug abuse *(especially stimulants)*, domestic violence, local feuds, gangs, guns *(especially pistols)* and edged weapons
- **Gunshot wounds:** Weapons in the home, alcohol, gangs, drug sales, depression
- **Fatal burns:** Cigarette smoking, wood burning stoves residences, lack of smoke detectors, smoking and drinking in bed or on flammable polyurethane furniture, alcohol, Christmas trees in the home, poverty, light cotton children's clothing, older pickup trucks with gasoline tanks mounted outside of the vehicle's structural protection.

Is unused or misused safety equipment increasing lethality?

- **Ejection:** Safety belts, infant/child safety seats
- **Head injuries:** Bicycle and motorcycle helmets
- **Residential fires:** Smoke detectors, sprinkler systems
- **Swimming:** Personal floatation devices
- **Gunshot wounds:** Gun safes, trigger locks
- **Boat drowning:** Personal floatation devices, survival suits

7. MAKE A PIN MAP:

One of the easiest ways to "pinpoint" the exact location of cluster sites is a simple pin map. Get an accurate map of your entire district. I prefer a topographic map that includes the highways because a topo map will include identifiable land features that will help you find the precise locations of incidents on the roadway. It's important to be accurate as to exact location. *(Installing a guardrail in the wrong place isn't going to help anyone.)* If you're not sure of a particular site, interview people who were on a call there and visit the site with them.

If you have milepost markers as location identifiers, tour your district and note the milepost marker number on your map along with an identifiable feature on the scene. A list or map of milepost markers and landmarks *(creeks, bridges, turnouts, passing lanes, etc.)* may be available from your roads department or the State Department of Transportation. Use prominent land features and milepost markers on your map to find the exact location of each fatal motor vehicle collision. Place a pin for each event. It's a good idea to mount your pin map solidly on a piece of corkboard, and to put a bit of glue on each pin before you push it in. If the pins start falling out, you'll have to go back and do it all over again!

To help keep track of incidents, you can use flags on the pins to indicate the type of fatality, use different colored pins for the different types of incident, or a identifier numbers and a table that refer to the chart. Remember to look at all traumatic fatalities. You may be looking for automobile collisions and find a cluster of drownings at a popular swimming hole, an auto/pedestrian cluster or perhaps an area over-represented for homicides.

Pay special attention to any location that has a high incidence of fatal trauma, particularly if that site is associated with multiple fatalities from single crash events. Sites that cause multiple fatality events may indicate a hazard so severe that it practically guarantees fatalities in every incident.

Pin maps work for more than just trauma. In "Merry Olde England," before anyone knew about germs, sanitation, or the spread of illness, there was a severe outbreak of cholera. People were beginning to panic. A physician credited with being the first epidemiologist, made a map precisely locating each ill person. The map showed a pattern. There was only one factor common to every person with the disease; **every affected person was using the same water supply**. Rather than trying to warn the residents about the dangers of that particular water supply, trying to convince everyone that they should boil their water before drinking it, or pushing through a law against drinking un-boiled water, **he merely took the handles from each of the pumps connected to the contaminated water source. The epidemic stopped.** Note that this was an environmental solution. He literally attacked the problem at its source. That is the power of having accurate data and one person who's not afraid to do something with it.

I once did a quick pin map for fatal cancer incidence on the Hoopa Reservation. As a preliminary investigation, I interviewed a group of tribal elders and senior caregivers from the local clinic. From them I obtained a list of names of people they knew who had died from cancer. Then I asked where the decedents had lived most of their lives and made a map. No surprise, there were clusters of patients who had died from cancer in particular areas of the reservation which was itself a hotspot for cancer within Humboldt County which is a hotspot in the state of California. Hoopa not only had an epidemic of Over-the-Bank motor vehicle crash fatalities, it also had an epidemic of cancer.

There were three places on the reservation that appeared on the pin map as obvious cluster sites. The first were in the vicinity of old lumber mills that made pressure treated lumber with pentachlorothiazine that had standing areas of black water during rainstorms. There were also cancer clusters near the old "Copper Mine," one of the ten worst "superfund" cleanup sites in the nation at that time. We also found cancer clusters in particular HUD housing projects with no apparent connection to any contaminant. The HUD locations puzzled me until I was informed by a knowledgeable local that when those homes were built, fill rock, used to level the foundations

and the yards, was obtained from the copper mine's tailings! These tailings were found to be highly contaminated with heavy metals from open pond leach fields. It is a good demonstration that when you find an area of increased incidence, there is usually a reason for it, whether you are investigating injuries or illness. To my knowledge these secondary sites of contamination have never been investigated further.

8. MAKE SITE VISITS. VIDEOTAPE, PHOTOGRAPH AND TAKE NOTES OF YOUR IMPRESSIONS AND MEMORIES:

Conduct a site visit. Once you have clearly established the exact location of your fatal cluster, take a video camera, a still camera or two, plenty of slide-film and videotape, spare batteries and some material for note taking. Visit the site in uniform and in your rescue unit if possible.

Have another EMT drive. If you visit the site in the rescue unit, you have a driver, another EMT to comment on tape on the aspects you may not be seeing, their stories of what they saw when they responded to calls at that location, and you have the added advantage of being visible in the community. This creates significant leverage on the responsible party without being overtly threatening. Gentle persuasion to fix a problem that they already are aware of can come in the form of visually letting them know that you are also aware of the problem and that you have publicly documented it.

The grapevine in a small community can work for you. *("Did you see the rescue squad out at dead mans curve yesterday?" "It looked like they were filming skid marks!")* A few people talking about this in the community will go a long way toward bringing the issue to the attention of the responsible party without any overt threats. *("Fix it or else.")* Sometimes this is all that is needed to move a known hazard off the back burner and closer to a resolution. People in the community will be relieved that someone is finally doing something about "Deadman's curve. It is a good first step towards short cutting the hazard resolution process, and excellent public relations as well.

HOW TO FILM THE CRASH SCENE:

Begin your filming about one-half mile from the site, drive to the site, and videotape the approach. Film the approaches from both directions a few times. Approach slowly at first, then at highway speeds. Comment as you go so the video will capture your thoughts. Try to get a feeling for what is happening there. Pay special attention to the direction that the fatal crashes tend to happen from. *(Some cluster sites have crashes that happen from both directions, some do not. One of our lesser cluster sites that still has not received any significant improvements is the East Fork Bridge on Highway 299. It has a sharp curve in a low spot whose approach is steeply downhill from both directions. It is also at an elevation where ice often begins to collect on the roadway. Crashes still happen at that site from both directions.)*

Adjust the camera's field of view and try a wide-angle approach, then narrow it down and try it looking at particular aspects of the site as you approach. The camera sometimes can capture what the eye cannot.

- What is different about this site from the roadway one-half mile away where there are no fatal crashes?
- What jumps out at you when you first approach the scene slowly? At highway speeds?
- How does the roadway look?
  - Smooth or in poor repair?
  - Wide or narrow shoulders?
  - Well marked with sidelines and centerlines clearly defined, or faded?
- How is the sight line approaching and going through the site? Are there obscuring factors such as a curve or brush alongside the roadway?
- Is there a downhill grade leading into the site?
- Are there clearly visible warning signs as you approach? Or are they missing or obscured.
- What is the speed limit? Videotape the milepost marker and a speed limit sign.

- Can you identify skid marks? Multiple skid marks are a sure sign that people are panic braking going into the site and likely to lose control Skid marks don't usually last long, so when you see some, tape them.
- Are there any impact signs, debris, fluid spillage, glass or paint marks you can capture on your camera?
- Is there an object such as a tree or a rock that clearly has been hit more than once? If so, be sure and capture the scarring. Trees may show various stages of bark healing, a sure sign of multiple impacts.
- Is there a downhill grade approaching the site?
- If there is a curve, does it appear to be fairly sharp? *(Curves of greater than six degrees have significantly higher rollover/overturn rates than those of less than six degrees.)*

When you feel you have captured the approach aspect of this site completely, set the camera up on a tripod alongside the road in a safe, visible location filming the approach of vehicles and capturing the impact site as well. You don't want vehicles to take undue notice of you and thus react differently, nor do you want them to pay attention to you and not their driving. Be discreet, and be safe! Once you set the camera up and it has the field of view that you want in clear focus, let it film by itself and watch the traffic approaching. Avoid the temptation to touch the camera, just let the camera capture what is happening.

- How do the vehicles move into and through the site?
- Is there a substantial weight shift from rear to front indicating hard braking?
- Do some of the vehicles show an off balance or swaying appearance?
- Is there some shift in the attitude of the vehicle that would tend to cause a loss of control if it was exaggerated?
- Does the shift in attitude appear to throw the vehicle toward the hazard?
- How close are their tires to the right side of the road, and to the centerline?
- Are you hearing any tire howl?

Next, film vehicles as they pass the hazard and proceed down the road away from the site. If you are filming on a curve, try to find the camera angle that best shows the attitude of the vehicle at the apex of the curve. You want to capture the hazard in the shot as well. Again, let the camera do the work, the less you fiddle with the machine, the better. Be patient.

Take some still pictures, focusing on any features you want to emphasize. *(I once photographed a mile post marker that had been hit multiple times, complete with multiple skid marks going straight into it and smashing the mile post marker into a log barrier. It was a very convenient way to document exactly where and how the crashes were occurring.)* Consider using slide film, slides display a much bigger and clearer picture when you are presenting your findings. Take stills of any skid marks as well as videotape, because they are some of the most telling physical features at any crash site. Try to capture skid marks by shooting repeatedly from different angles and in different lighting. Take the tape back home and review it. Did you catch what you wanted? If not, it's worth doing again.

Graphic photographs and videotape strengthens your case dramatically. If you can take a disposable camera along on the ambulance units, it's often useful for snapping shots of the scene as you enter. Footage with the wreckage on scene is some of the most valuable evidence you can collect. Videotape and photograph extensively after any crash incident. The period of time immediately following a serious crash is a "teachable moment" when the information that you are trying to impart is graphically represented by a real incident. Teachable moments result in an increase in the likelihood that the information you are trying to convey will result in an improvement or change in behavior. Take advantage of every teachable moment, they are extremely effective motivators. Remember to be sensitive to the feelings of survivors and be selective about what and how you record, what you show to the public, and how it's presented.

Pictures of the crash vehicles can be valuable even when the vehicles are no longer on scene. If you have access to the crash vehicles at the local junkyard, you may want to videotape the wreckage looking for specific impact marks, structural failure, passenger compartment intrusion, interior damage that indicates impact by the occupants, etc. Combined with footage from the scene, shattered vehicles complete the picture and they effectively show the energy transfer from the hazard, through the vehicle, to the occupants.

9. FOCUS ON ENVIRONMENTAL HAZARDS AT THE SITE. TRY TO FIND ENVIRONMENTAL STRATEGIES.

Effective environmental modifications are "equal opportunity solutions" to fatal events. The most effective motor vehicle collision injury prevention solutions are those that don't require any behavioral change and that protect everyone equally. Environmental solutions are often the best and simplest option, so look for them first. At cluster sites, there are hazards that threaten everyone.

Don't be side tracked into blaming the injured people or thinking, "It's just another damned drunk driver." Think instead, "how can that drunk driver *(and everyone else)* be best protected from another fatal crash at this site?" Drunk, sober, poor, rich, Native American, non-Native, intelligent or foolish, an effective environmental solution protects everyone equally. Effective environmental modifications work around the clock in any weather and under all conditions. Once an effective protection is in place, the fatality problem ceases to exist.

Some common environmental solutions:

- Install a barrier, guardrail or energy-absorbing device to isolate traffic from the hazard
- Remove fixed objects within 50 feet of a highway
- Add breakaway supports for light standards and signs within 50 feet of the roadway
- Modify road surface to improve traction and smoothness, improve striping
- Improve signage, install lighting
- Install traffic signal or other flow controls in high traffic areas
- Reduce speed limits, add speed bumps or "roundabouts" in areas with high traffic and pedestrian flow
- Build pedestrian walkways and crossings physically separated from the traffic
- Add rumble strips or "Bott's dots" along highway shoulder where run off road crashes and rollovers occur
- Light residential areas where auto vs. pedestrian crashes occur at night
- Separate opposing traffic and widen the road in areas with high frontal impact incidence
- Correct "off camber" curves where rollovers are common
- Install pedestrian and bicycle pathways remote from the traffic lanes
- Repair missing or worn road edge striping, center lines and no-passing stripes
- Install turning lanes and widen shoulders in areas with a high incidence of auto vs. auto crashes
- Install improved smoke detectors with 10 year lithium batteries and annoyance reset buttons in residences with cigarette smokers and those that use wood heat, especially if there are elderly or very young children in residence
- Check the length of the yellow phase of stoplights at any intersection that is over represented for broadside collisions. Lengthen it if it is shorter than those at non-crash locations
- Install pool fencing that is not attached to the home and has an automatically locking gate to prevent toddlers from drowning
- Install emergency call boxes in remote highway areas to reduce EMS notification time
- Inspect popular swimming/diving holes and remove any submerged hazards, divert hazardous currents
- Build comfortable lifeguard-lookout areas at public beaches
- Install hand railing in showers and tubs in the homes of the elderly to help prevent serious fall injuries

10. DOCUMENT YOUR FINDINGS

Make a report linking your review of the data with the information you gained from the site visit. Take time to document each cluster site you've identified during your research. Include a summary of your data, make a short video or photographic presentation and include the most promising strategies for solving the problem. An accurate, one-page executive summary with facts and logical conclusions including an environmental strategy is a very effective tool.

Accurately documenting your findings forces you to clearly state exactly what you have found, what conclusions you have reached and what you propose to do about it. This helps you focus your thinking and may point out issues that you have overlooked. Having this information in a concise form will help you during negotiations with the agencies that are responsible for fixing the problem.

Your report is only as valid as the data you collect. Your conclusions must be supported by accurate, specific data. Make sure to include only data that is specific to the particular problems you want to correct. Don't over reach or draw wide-ranging conclusions about other similar situations. Don't speculate. If you don't have sufficient data on a problem, get appropriate supporting data before you put it in your report.

Don't add confusion. A fatal vehicle crash near but not at the cluster site you're researching is not important to the study of your specific site. Unrelated information will confuse people and weaken your report. Save any data that isn't specific to the problem for a future investigation.

Use anecdotal examples carefully or not at all. An anecdote is a story told by someone that is not substantiated by data. It is defined as, "an illustrative story or fable." Using anecdotes can backfire on you. They can damage your credibility and bring into question the accuracy of your work. However, anecdotal evidence supported by data can be very powerful. For example, telling the story of a family's struggle with the aftermath of a death or spinal cord injury can graphically illustrate the severity of a problem and bring emotional pressure to bear on the agency responsible for correcting a problem. The downside of using this kind of pressure is that it can harden the resistance of any agency that feels threatened by their potential liability in the incident or by your assertion that they are at fault. If your data is accurate and thorough, it has plenty of power by itself, I recommend saving the anecdotes for the courtroom.

Litigation stalls your project so try to avoid it. Many organizations and lawyers assume that if they correct an obvious problem, they are accepting responsibility for all the injuries caused in the past. If lawyers get involved before the problem gets fixed, things usually do not progress as quickly and they may come to a complete halt. Intelligence, logic and the "public good" are not always at work in these matters. Your interest in protecting the public from fatal injuries may be very different from the responsible agency's interest in protecting itself from possible liability and from their lawyer's interest in a nice long case with a resultant juicy fee.

Avoid the pitfall of blaming, think win/win. Blaming only raises defenses against you and may cause legal logjams. In my view, taking the direct, confrontational approach with any agency or individual that is responsible for fixing a problem is an option, but should be your last option. Keep in mind that your primary goal is to effect change, not to establish fault and place blame. Try to find a way to provide some benefit to the responsible party as well as to the public, just be careful not to make promises that you can't keep.

Consider using a computer database program to organize all of your data. If you are only planning to investigate motor vehicle fatalities, you probably don't need a database program. In that case, sorting and comparing by hand is the simple low-tech alternative. However, if you have a very busy or large district, or if you choose to look at many different fatal events, it's useful to build a database program so that once the information is inputted, you can run quick analyses on the data using any variable in the database. Some surprising and interesting results can come from looking at data that is sorted by many different variables.

Consider having a professional design your database to your specifications. Building the database and inputting data can be time consuming, but if you have a lot of data to sort through, it will save you time and effort in the long run. Most modern database software will be useful, but some are easier to use than others. If you are facing a major data inputting and sorting job, the fee for a few hours of design can help you avoid a lot of headaches later on.

Be accurate when inputting all data. Either do it yourself, carefully, and triple check yourself, or have someone who is conscientious do it under your supervision. Remember, "Garbage in, garbage out." Incorrect "facts" in your report may be seized on by responsible parties to discredit all of your otherwise accurate work. Make sure that what goes into your report accurately represents *(and doesn't over-represent)* what has happened. Be factual.

11. IDENTIFY RESPONSIBLE AGENCIES, INDIVIDUALS AND RESOURCES TO HELP IMPLEMENT THE SOLUTION.

Present your findings to the appropriate party or organization. Be professional and courteous and avoid confrontation. Wear the other person's shoes for a while. It's not fun to have people from outside your agency confront you with problems that you are responsible for, especially when they have resulted in death and disability. They will initially feel threatened and defensive, so try to reassure them that your only interest is in getting the problem fixed before it causes another death. Try to establish a working relationship with them, not an adversarial one. Remember to think win/win. Keep in mind that everyone's budgets are tight and your site may very well have been recognized previously and shelved while waiting for the money.

Play the videotape and show the slides. Graphic visual representation of the hazard, along with accurate, well-documented research, and a reasonable plan for an environmental intervention provides the best chance for success. The informed, cooperative approach is the path of least resistance and often the quickest one. Try that one first.

12. BUILD A CONSENSUS ON THE PROBLEM AND ON THE BEST POSSIBLE SOLUTION.

Building support for your plan in the community will raise the visibility of the problem and it costs nothing. If you've gone the cooperative route and reached an impasse, you will need some people on your side. A good place to start building consensus is with is other local emergency services. They have a stake in the success or failure of your project. They will be responding to that site again and again until it is fixed. They will relate to your concerns and probably be easy to convince, especially if you have a well thought out solution. Physicians, nurses, firemen, police and EMT's have clout in that people trust them with their lives. When these people say something is hazardous, people tend to listen. Get them on your side.

Be prepared with a relatively inexpensive, well thought out plan of action that can be implemented quickly. Things can get tricky when you bring in other individuals, agencies, groups or committees. Well-meaning people coming in late, who have no injury prevention background will tend to immediately suggest better law enforcement, educational campaigns, and beefed up emergency services *(particularly if you're talking to police, fire, and emergency personnel).* While there's nothing wrong with any of these, **the plan most likely to succeed will be proactive and environmentally based, so be sure to come prepared with a plan that clearly identifies and addresses the specific hazard at the source**. Avoid getting side tracked. If you've done your homework, you know what the problem is and have a pretty good idea what to do about it. Take the reigns and head for your goal so that people will follow you and hopefully not stampede off in their own directions.

Once you have the support of a group, return to the responsible person and present your case again. Advise them that you have built a consensus among community members and that you all agree that something needs to be done now. Having the backing of the community greatly strengthens your case.

13. EVALUATE THE EFFECTIVENESS OF YOUR INTERVENTION.
Follow up on the success or failure of your efforts. Usually once a hazard is removed and an effective protection is in place, the hazard is no longer an issue. However, some new unforeseen issue at the site may arise, or the intervention may not have the desired outcome. The only way to know is to follow the data at that site for a few years afterward. This is usually pretty easy because there won't be any data. The problem will have ceased to exist.

Reviewing the data at an ex-cluster site is a rewarding exercise because you will notice the lack of fatalities at that site within a year or two. Every year after that is another year without fatalities. Documenting the success of your project is almost as important as documenting the problem itself. A successful project can provide you some much-needed credibility when you take on a new hazard

Be a model. A truly effective and innovative solution that has been properly evaluated has a value far above and beyond the correction of one specific problem. If your solution is effective, it may work at other sites in your district, or it may serve as a model for other programs to copy.

VII. INJURY PREVENTION STRATEGIES: HOW TO FIND THE ONE THAT WORKS BEST

"In choosing among potentially useful preventive measures, priority should be given to the ones most likely to effectively reduce injuries. In general, these will be measures that provide built-in, automatic protection, minimizing the amount and frequency of effort required of the individuals involved." (Haddon, 1974)

There are as many different prevention and control strategies as there are problems. One of the best ways to investigate potential strategies is to use "Haddon's Matrix." The matrix looks at 12 different "boxes" in which any injury event can be examined. The matrix was designed by William Haddon, Jr., the first head of the National Highway Traffic Safety Administration (NHTSA). During his directorship at NHTSA (1966-1970), Haddon and his colleagues were directly responsible for research into fatalities caused by the unsafe and unforgiving structure of automobiles at that time. Their investigations and the vehicle modifications that resulted led directly to a reduction of approximately 50% in motor vehicle crash fatalities. Safety glass, collapsible steering columns, padded interiors, and lap/shoulder belts are all results of their research.

Haddon's Matrix allows you to look at variables in the Human, the Vehicle (Vector of injuring energy), and the Environment (Physical and Socio-cultural), before, during, and after an injury event. Identifying these variables can help identify strategies to prevent an injury event from occurring, or control the severity of the injuries during the event. The trick to using Haddon's Matrix is to think up as many different possible causes and solutions to a specific injury event as possible. Even bizarre ideas can sometimes lead to innovative strategies, so stretch your imagination! Without innovative thinking, we wouldn't have the "Wiffle Ball", "Nerf" toys or breakaway baseball bases that prevent leg fractures during slides, *(all excellent examples of effective injury control strategies).*

The following is an example of Haddon's Matrix as used to investigate the problem of motor vehicles leaving the roadway and rolling over down steep and high embankments. This is a real problem that our EMS dealt with in the Hoopa EMS district of Northern California.

HADDON'S MATRIX FOR OTB FATALITIES
HOOPA INDIAN RESERVATION, CALIFORNIA 1983

PHASES	HUMAN	VEHICLE	ENVIRONMENT	
			PHYSICAL	SOCIO-CULTURAL
Pre-Event	Age Experience Speeding Reactions Emotions Alcohol/drug use Fatigue Peer pressure	Vehicle model & size Horsepower Handling Tires State of repair Brakes	Speed limits Road design Gradient Width Signage Surface Weather Barriers	Native American-customs and beliefs Local driving customs Laws Peer pressure Running from police Alcohol and drug use
Event	Position in vehicle Ejection Entrapment Health Alcohol and drugs	Impact direction(s) Speed Safety belt use Restraint system Deformation Vehicle construction Vehicle size	Slope Height Fixed objects Immersion in river Penetration Inadequate Barriers	
Post-Event	Age/health Medical problems Intoxication Injuries Medications	Metal deformation Gas tank integrity Ignition sources	Temperature Weather Remoteness Visibility Notification Terrain Rescue difficulties	EMS response system. Mutual aid. Advanced Life Support. Med-evac

HADDON'S TEN STRATEGIES FOR INJURY PREVENTION AND CONTROL

In addition to his matrix, Haddon went on to identify ten strategies that, when combined with the matrix, can be used to help us zero in on the best possible interventions for any given injury event. (Haddon), *Hazard Prevention 16: 8-12*

1. **Prevent the creation of the hazard in the first place.**
    a. Yard darts
    b. Cop-killer bullets
    c. Three-wheel ATV's

2. **Reduce the amount of the hazard that exists.**
    a. Reduce horsepower in vehicles
    b. Restrict motorcycle licensing to older drivers

3. **Prevent the release of the hazard.**
    a. Gun safes
    b. Trigger locks
    c. Childproof medicine containers

4. **Modify the rate of spatial distribution of release of a hazard from its source.**
    a. Breakaway baseball bases
    b. Ski bindings

5. **Separate people in time or space from the hazard and its release.**
    a. Bicycle and pedestrian pathways
    b. Avalanche release during non-skiing hours

6. **Separate people from the hazard by interposing a material barrier**
    a. Raised median strips
    b. Guardrails
    c. Energy-absorbing barriers on fixed objects

7. **Modify the relevant basic qualities of the hazard.**
    a. Safer playground equipment
    b. Softer playground surfaces
    c. Hot tap water settings of below 120 degrees

8. **Make the person more resistant to damage.**
    a. Physical conditioning of athletes

9. **Counter the damage already done.**
    a. EMS

10. **Stabilize, repair, and rehabilitate the injured person.**
    a. Reconstructive surgery
    b. Physical therapy

DECIDING ON THE RIGHT STRATEGY:

Ask yourself this: Given all the variables of this particular situation, what can you most easily change, control, or modify that will prevent this crash from occurring? What will reduce the severity of any crash that occurs here so that it will not result in serious or fatal injuries? Consider which of these protects every other user of the road with no action on the part of the protected person. That strategy is the most likely to be the most effective one.

VIII. SOME COMMON CLUES TO LOOK FOR IN YOUR RECORDS

LOCATION AND FEATURES:

- **Particular stretch of highway**-- *("Blood Alley")*—High-speed, frontal collisions are associated with undivided straight roads
- **Curves**-- *("Dead man's Curve")*—Downhill grades with curves of greater than six degrees are over represented for rollover/overturn crashes
- **Intersection**—A traffic light sequence with a yellow phase that is a few tenths of a second too short will result in a much higher collision incidence than one with a longer yellow phase
- **Unlit residential area**—Lack of lighting, highway speeds, obstructed visibility, no sidewalks and children playing near a busy roadway are common features of auto vs. pedestrian crashes. Alcohol and the elderly are also associated with auto vs. pedestrian fatalities, so a darkened area of highway with a bar or convenience store across from a primarily elderly residential area has potential
- **Time of day**—Bar break and 5:00 PM are over represented in traffic collisions
- **Traffic patterns**--Auto vs. auto collisions tend to happen during peak flow periods. Single occupant rollover crashes usually happen late at night on relatively deserted highways. Roads leading from a "wet" county that allows alcohol to a "dry" one are over represented for late night crash deaths due in part to commuting for alcohol
- **Uncontrolled side streets with no turn lanes and narrow shoulders**—A common cause of rear-end collisions. On busy two lane highways, vehicles stopping in the traffic

lane to turn left sometimes shoot into the opposing lane when struck from the rear causing a secondary high-speed head-on collision with oncoming vehicles.

- **Steep embankments, ditches, culverts, fixed objects, trees and bodies of water**--are all severe hazards in run off road crashes.
- **Swimming holes in rivers**—These often change from year to year, the local friendly swimming hole may not be so friendly when the runoff is a little higher or colder than usual, or when a submerged root ball has rolled into the diving area during high water. The busiest swimming areas without lifeguards often have hazardous features that make them popular--rope swing, diving cliffs, fast water etc. Particularly hazardous times of year are, in warm weather during spring break, Memorial Day and the Fourth of July.

IX. WHAT TYPE OF FATAL EVENT IS OCCURRING HERE? SOME TIPS ON COMMON PROBLEMS

The following is excerpted from:
The Injury Fact Book, Second Edition
Baker, Susan P., O'Neill, Brian, Ginsburg, Marvin J., and Li, Guohua)
New York Oxford
Oxford University Press, 1992.

URBAN VS. RURAL OCCUPANT DEATH RATES

"Occupant death rates in all types of crashes combined are highest in the southern and western parts of the United States. Mapping by county shows that the counties with the fewest people per square mile have the highest death rates...."

"*...The high rates in rural areas in part reflect poorer roads and trauma services but are also strongly influenced by the higher speeds involved in many rural crashes. High blood alcohol concentrations, however, are not more common among occupants killed in rural areas." (Pg 239)*

TYPE OF ROAD AND SPEED LIMIT

"Death rates on various types of roads depend on the amount of travel as well as type of road, which influence both the incidence and severity of crashes. When adjustments are made for the amount of travel… rural roads have higher death rates per 100 million miles than do urban roads. This is true for interstates and other limited-access highways, and, to an even greater extent, for roads where access is not controlled...." (Author's note: As of 1992, there were 3.5 deaths per 100 million vehicle miles on uncontrolled-access rural roads vs. 1.3 deaths per 100 million miles on urban roads.)

"…The ratio of occupant deaths to injuries increases dramatically with the speed limit, from about 5 deaths per 1,000 injuries where the limit is 30 mph or less to 31 per 1,000 where the limit is 55 mph." (Pg 249-251)

ROLLOVER/OVERTURN

"About 8,000 occupants are killed each year in vehicles that overturn. Death rates for such rollover crashes, which are the highest in the mountain states are related not only to the gradient and curvature of roads but also to the absence of recovery areas and guardrails, which would prevent vehicles that leave the roadway from rolling down an embankment or overturning after striking a curb, ditch, or culvert...."

"...Embankments were cited in 1,300 fatalities in 1983, and curbs, ditches, or culverts were cited in 2,000." (Pg 242)

"...About one-tenth of all occupants in towaway crashes are in vehicles that overturn. These rollover crashes have high death rates—almost three times the rate for nonrollovers...partly because much larger proportion of occupants (5.4%) are ejected from their vehicles in rollovers, compared with only 0.4 percent

ejected from vehicles that do not roll over. Ejection is associated with a fourfold increase in the risk of death... (Pg 246-247)

ROLLOVERS, "THE STATIC STABILITY FACTOR" VEHICLE HEIGHT AND TRACK WIDTH:
Excerpted from *"The Expert Witness Scam*", Robertson, L., 2000
Free on the World Wide Web at: **www.Nanlee.net**

"...CJ refers to the civilian jeep. Several variations were sold to the public identified by number -- CJ5, CJ6, CJ7. They were modified versions of the utility vehicles used by the military prior to the development of the wider, more stable, Humvee. Other manufacturers also sold vehicles based on military designs -- Ford's pre-1978 Bronco, Volkswagen's Thing and Toyota's Landrover and Landcruiser. ***In 1967, the US Army reported that 57 percent of fatal crashes of military jeeps in Europe were rollovers. In 1971, when the army began selling surplus jeeps to the public, the National Highway Traffic Safety Administration recommended that the sales cease because of safety concerns and the army complied. Yet the federal safety agency did nothing about the civilian version.*** *(Emphasis added) The jeep-like vehicles share a common characteristic. Their weights are relatively high off the ground and the distances between the center of their tires (track width) are relatively narrow. This combination produces an unstable vehicle when the ratio of the two factors is low. Anyone who has sawed a piece of 2 by 4 lumber has noticed the stability problem. If the lumber is placed on its two-inch side, it will rock back and forth. On its four-inch side, it is stable and easy to saw. Placement on its four-inch side lowers the weight closer to the ground and increases width of the bottom...*

...If you are interested in a vehicle that appears higher off the ground than a passenger car, ask the dealer for the height of center of gravity. If you get it, divide the track width in the sales brochure by the center of gravity height. If the result is 2.4 or greater (the same as a T/2H of 1.2), don't worry about stability. If it is below 2.4, don't buy it and find one that is 2.4 or higher. If the dealer won't tell you the center of gravity height, find one who will or don't buy the vehicle." *(Emphasis added)*

NHTSA is now rating vehicles according to center of gravity height and track width. They call T/2H SSF (Static Stability Factor). See **http://www.nhtsa.dot.gov/hot/rollover/fullWebd.html**

FIXED OBJECTS

The following is excerpted from:
The Injury Fact Book, Second Edition
Baker, Susan P., O'Neill, Brian, Ginsburg, Marvin J., and Li, Guohua)
New York Oxford
Oxford University Press, 1992.

"Collisions with trees, which claim about 3,000 lives each year, are associated with high death rates in the eastern third of the country. Collisions with utility poles, which result in 1,400 deaths annually, also have high rates in eastern states, especially the Northeast. These differences reflect the fact that many roads in the East are bordered with trees and that utility poles often are very close to the road, especially in areas where they were installed early in this century when roads were narrow. It is possible to identify trees, poles, and other structures that are in especially hazardous locations (e.g., sites that combine a downhill gradient with a road curvature of more than six degrees) and to remove, reposition, or shield such objects in ways that protect vehicle occupants...."

"...Where signs and light supports cannot be moved or shielded with energy-absorbing structures, breakaway structures that yield on impact reduce injuries when crashes occur." (Pg 242)

PASSENGER VEHICLES VS. TRACTOR TRAILER TRUCKS

"...more than 5,000 deaths occur each year in crashes involving large trucks. In such crashes, other road users have especially high fatality rates: 84 percent of the deaths involve persons who were sharing the road with the large truck

"...truck drivers have the eighth highest occupational death rate among 347 occupations studied..."

"...The risk of crashes of large trucks has often been under estimated because about one-half of their mileage is on relatively safe interstate highways, compared with less than one-fourth of passenger vehicle mileage..."

"...as a result, their overall crash involvement rate is low when no adjustment is made for category of road. On comparable roads, however, tractor-trailers have higher rates of crashes than passenger vehicles."

"In addition to high crash rates, fatality rates are high when crashes involve large trucks—largely reflecting the tremendous energy exchanges during the crash phase because of the mass of the truck. Head on crashes between trucks and passenger vehicles are especially unforgiving for the occupants of the passenger vehicles." (Pg 262-264)

VEHICLE IMMERSION

"Drowning rates associated with vehicle immersion are highest in Alaska, the Northwest, and several southeastern states. In Florida, where about 45 motor vehicle occupants drown each year, the number of occupant drownings per 100 million vehicle miles is about twice the national average. In Sacramento County, California, sites where drownings in motor vehicles occur involve roads with a greater mean curvature than control sites...."

"...In many states with high rates of motor vehicle related drowning, the lack of physical barriers or spatial separation between roads and canals or other bodies of water no doubt contributes to the likelihood of vehicle occupant drownings." (Pg 242-243)

MOTOR VEHICLES VS. TRAINS

"The geographic patterns vary for different types of crashes. For example, death rates from collisions with trains, which kill about 600 motor vehicle occupants annually, are highest in the central part of the United States. Most of these states have especially large numbers of rail-highway crossing on the same level (referred to as "at grade") with no protection other than warning or stop signs." (Pg 239-242)

RESIDENTIAL FIRES

"Among deaths from fires and burns, housefires cause 73 percent of all deaths and 80 percent of unintentional deaths.... Death rates are highest among young children and the elderly….

"Cigarettes, cited in 28 percent of the deaths, are the leading cause of fatal housefires, which are often started by smoldering cigarettes that ignite upholstered furniture or mattresses....

"Among both blacks and native Americans, housefire death rates are more than twice the rate for whites." (Pg 162-163)

AUTO VS. PEDESTRIAN FATALITIES

"Pedestrian deaths, the second largest category of motor vehicle deaths, include almost half of the traffic deaths for ages 3-9 and more than one-fourth for ages 75 or older. In 1988, almost 7,000 people were killed as pedestrians, representing about one-seventh of all traffic-related deaths."

"The speed of vehicles involved in pedestrian impacts is a major determinant of the severity and outcome of injury. This is reflected in the much higher ratio of deaths to injuries where speed limits are higher. The ration of deaths to injuries is about nine times as high where the speed limit is 55 mph as on roads where it is 30 mph or less." (Pgs 272 & 277)

DROWNING

The following excerpted from:
National Institutes of Health
National Institutes of Child Health and Human Development
July 2, 2001
http://156.40.88.3/new/releases/drowning.cfm

National Study Examines Sites Where U.S. Children Drown

"Infants are most likely to drown in bathtubs, toddlers in swimming pools, and older children in other freshwater sites such as rivers and lakes, according to a study funded by the National Institute of Child Health and Human Development (NICHD)….

The research, the first to present national data on where U.S. children tend to drown, was published in the July issue of Pediatrics

About 1,500 children drown each year in the United States. Consistent with previous studies, the new study found that toddlers and adolescent males had increased risks of drowning, and, among adolescent males, rates were higher for African Americans than whites.

"While toddlers were most likely to drown in swimming pools and adolescent males in other freshwater sites, the reality is more complex," said the study's lead author, Ruth Brenner, M.D., M.P.H., of NICHD's Division of Epidemiology, Statistics, and Prevention Research. "Toddlers are also drowning in other freshwater sites like ponds, lakes, and rivers, and, after five years of age, about a third of drownings among African American males are in swimming pools."

Information for the study was collected from the death certificates of 1,420 children under 20 years old who died by unintentional drowning in 1995. The researchers grouped specific drowning sites into four categories: artificial pools (swimming pools and hot tubs), freshwater bodies (lakes, ponds, rivers, canals and other specified sites), domestic sites (primarily bathtubs and buckets), and salt water. This information was then analyzed by age, region, gender, and race.

Thirty-seven percent of children who drowned were between one and four years old, and 29 percent were between 15 and 19 years old. ***Seventy-four percent of children who drowned were male.****(emphasis added)*

Among infants, the majority (78 percent) of drownings occurred in the home, primarily in bathtubs. Toddlers between the ages of one and four years were most likely to drown in artificial pools (56 percent), but other freshwater sites also accounted for a sizable proportion of drownings (26 percent). Children over five were most likely to drown in freshwater: 54 percent, 61 percent, and 69 percent among 5-9, 10-14, and 15-19 year-olds, respectively….

Other authors of study were Ann C. Trumble, Ph.D., of NICHD, Gordon S. Smith, M.B., Ch.B., M.P.H., of the Johns Hopkins University School of Public Health, Eileen P. Kessler of the Consumer Product Safety Commission, and Mary D. Overpeck, Dr.Ph., M.P.H., formerly of NICHD and now with the Maternal and Child Health Bureau."

The NICHD is part of the National Institutes of Health, the biomedical research arm of the federal government. The Institute sponsors research on development before and after birth; maternal, child, and family health; reproductive biology and population issues; and medical rehabilitation. NICHD publications, as well as information about the Institute, are available from the NICHD Website,"
http://www.nichd.nih.gov, or from the NICHD Clearinghouse, 1-800-370-2943; E-mail **NICHDClearinghouse@mail.nih.gov.**

Additional information on water safety and drowning prevention can be found on the CDC website, **http://www.cdc.gov/od/oc/media/pressrel/r010525.htm**

DROWNING BEHAVIOR:

The following is information provided to the author by an instructor for:
Rescue III International
Swift water rescue technician course

Drowning behavior, what it looks like and how to recognize it: Contrary to popular belief, a drowning swimmer usually will not call out or signal for help. Most reports of witnessed drownings indicate that the swimmer seemed to be actively "swimming" did not call for help, and then disappeared beneath the surface without a sound. Instead of calling for help or waving, a drowning person's energy is focused on keeping their nose and mouth above the surface of the water and catching a breath. As they tire, their lower body begins to sink. This causes them to quickly assume the "Crucifix position" *(body vertical in the water, arms extended straight out from the shoulders and rapidly pushing against the water, or "dog paddling" rapidly, head tilted back with nose and mouth the highest point above the surface.)* They appear to be trying to literally crawl out of the water, straight into the air. This is a very inefficient way to maintain floatation. Once in this position, stricken by panic, the victim becomes solely preoccupied with keeping their mouth and nose in the air. Raising an arm to call for help causes their body to sink a bit, and yelling interferes with the act of snatching a breath when above the surface.

Most people in the United States are not aware of this drowning behavior *(which is commonly seen in any pool area where weak young swimmers "dog paddle").* **Rapid dog paddling with the body vertical and the mouth and nose barely out of the water is drowning behavior not rudimentary swimming! The public should be taught to recognize it.**

Lifeguards at the Coney Island beach in New York were the first to document drowning behavior. At the Coney Island Beach, it was known that there was a specific area of beach that was over-represented for children drowning *(cluster site).* In order to better monitor this area, cameras were installed and hooked to videotape machines. What they recorded was repeated instances of children reaching a certain distance from shore, and suddenly exhibiting the crucifix position and paddling for their lives to stay afloat. This was due to a step off of a foot or two on the bottom at that location. This step off was not high enough to disturb the adults, but just high enough to bring the depth of the water over the children's heads. The parents were often oblivious to this; in fact, there is a recording of a man standing between his two young children merrily chatting away while they both exhibit drowning behavior on either side of him. The Coney Island lifeguards adopted a policy of swimming to the rescue immediately when anyone exhibited this behavior and there was a resultant steep drop in children drowning at that location.

SUICIDE

The steady upsurge in suicide is an epidemic. It has replaced homicide as the leading cause of intentional injury death in the United States. Suicide tends to cluster; when a loved one commits suicide, the friends and family are at increased risk to commit suicide. People who have unsuccessfully attempted suicide are also at greatly increased risk of successfully completing the act in the future. Effective efforts to reduce suicide and suicidal behavior must address the problem at its source, focusing on the suicidal people themselves. The current system of mental health intervention works for people during the crisis by stopping their attempt, placing them in a safe environment and evaluating their mental status, but it often ignores them once their immediate crisis has passed. Suicidals are commonly back in their same situation within 72 hours with little or no follow up, angry, and determined not to fail on the next attempt. Outreach programs, crisis lines, and accessible peer support can help maintain contact with suicidal people and will help reduce the incidence of repeated attempts among this risk group.

Multi-disciplinary, community based outreach, intervention and research programs are critically needed at this time. Innovative new ideas to reach out and maintain contact with suicidal people, to gain their trust, offer support, guidance, and friendship are vitally needed. For more information on this subject, please contact the author at: **dshort@firedept.net**.

X. BLAMING THE INJURED: HOW NOT TO UNDERSTAND WHAT HAPPENED

Why blaming the driver misleads us. When you find repeated fatal events at a certain spot under similar circumstances, it's hard to claim that it was all the fault of the driver. If it were solely the driver's fault, the events would be randomly dispersed along the length of the roadway. A cluster indicates that there is some underlying reason for the injury event. A statement such as, "Another damn drunk driver crashed into that tree out on deadman's curve", misses the point that, drunk or not, if there was no tree to crash into, there would be no fatalities. This is why we should try to avoid dismissing fatal injury events by placing blame on the injured and the responsible parties.

Removing a hazard at a cluster site protects everyone, day and night, in all weather, drunk or sober, automatically. In this way, it is much more effective than trying to get all the drunk drivers off the road. A hazard that collects drunk drivers will occasionally get a sober one as well. Although drunk driving is a crime and stupid as well, the offender should not suffer death as a result of their stupidity when it is preventable. *(Thanks to Leon Robertson for arguing this point with me back in 1983 during the Indian Health Service-Injury Prevention Specialist course)* For more information on this, see the case study on the Death of Lady Diana Spencer in Appendix 1.

XI. URBAN VS. RURAL TRAUMA DEATHS:

There are many factors that increase the chances that a patient will not survive a motor vehicle crash in rural America:

THE RURAL ROAD SYSTEM:

The rural road system is much more hazardous than urban roads. Even though modern freeways are designed to conduct traffic at a mere 15 miles per hour faster, they have many built-in protections that rural roads do not.

The rural road system is designed to usher motorists comfortably down a smooth, narrow corridor at speeds in excess of 50 miles per hour, not for vehicles that lose control. Rural roads are fine as long as nothing happens to interrupt the smooth progress of a vehicle down a twelve-foot wide lane of pavement. Unfortunately there are many things that can interrupt this smooth motion. High-speed rural roadways are unforgiving when a vehicle crosses the centerline or leaves the asphalt. There are no barriers that separate us from going head-on with opposing traffic. Wide, flat shoulders that provide a safe reentry to the traffic lane and barriers that protect us from hurtling off course into a fixed object, a body of water, or an extended rollover crash are literally "hit and miss". Once any vehicle is out of control for even a brief moment, the rural highway ceases to be a safe, comfortable place and suddenly becomes a potential death trap.

Driving at highway speeds on a smooth road surface, insulated in our climate-controlled, quiet, comfortable vehicle, we can easily forget that opposing traffic is blasting by on our left at a combined speed of over 100 miles per hour. We can placidly ignore the fact that if our vehicle drifts gently off the road, what awaits us is an uneven, soft, rutted, slick or sloped surface that can jerk us violently out of control in a split-second, resulting in an abrupt over-correction and a high speed impact with opposing traffic, an extended rollover, or a violent smash up into a solid object. Or, we may go hurtling off course, completely at the whim of chance, the presence of hazards nearby and our built-up kinetic energy.

ROADWAY HAZARDS:

Adjacent to rural roads, there are often unprotected solid objects; these include embankments, ditches, culverts, poles, large rocks, etc. Debris and potholes may litter the traffic lanes. Wild and domestic animals wander the roadway and dart out. People walk and bicycle along the sides of the highway in the dark, with no sidewalks or curbs to separate them from the passing traffic and no lighting to illuminate them. Signage and roadway markings are sparse and sometimes in poor repair or obscured by greenery. Greenery growing up along the roadside can increasingly obscure approaching traffic until sight lines become dangerously inadequate. Concealed, unlighted, uncontrolled driveways are common.

Turning lanes are only found in the more built-up areas. Traffic stopping abruptly on the highway to negotiate a 90-degree turn presents an obstruction to through traffic and a risk of a sudden high speed rear-end or angled collision. Sharp curves are frequent and sometimes off camber and deceptive. Gradients change often and abruptly. Water standing in low spots in the road or running across the surface is common. Ice and snow can build up rapidly in the mountainous regions where the roads are long, removal services are sparse and the highways are steep and crooked. Standing deep water often abuts the roadway. *(A bumper sticker that used to be popular in the mountains of Humboldt County said "Pray for me, I drive highway 299". I often wanted to have one made that said in reply, "Don't bother! I drive highway 96.")*

People who drive rural roads every day often become complacent and frequently travel speeds considerably higher than the posted speed limits, vastly increasing the risks and the potential for fatal injuries. Kinetic energy increases with the square of velocity, therefore a vehicle going 60 miles per hour will impact with a force four-times greater than one traveling 30.

EMS:

THE DIFFERENCES BETWEEN URBAN AND RURAL EMS CALLS:

A one-hour response to an vehicle crash with an entrapped driver and a head injured child; an extended on-scene time while extrication is performed; and a one-hour transport with a non-breathing pediatric patient and a hypotensive, vomiting adult over mountainous country roads will try the skills *(and stomach)* of any ambulance attendant. Many rural EMT's in this situation would consider themselves lucky to have a third crewman along, scavenged from the on scene volunteer fire department that can follow instructions and bag the child.

To an urban EMT whose response times and transport times are usually less than 15 minutes, who have all the mutual aid that they need from numerous emergency services, who frequently respond with an extra EMT on board and who may have to negotiate a traffic jam or a few overpasses enroute to the nearest trauma center, the above scenario is almost unthinkable. To an EMT in rural America, it is common.

The definition of a "Good call":

It always amuses me when I share war stories with urban EMT's how their eyes often get big and they exclaim "Damn! That sounds cool!" "We never get any good calls!" If the definition of a good call is spending hours with unstable patients, speeding down dangerous roads, using every skill you possess just trying not to lose ground and wondering how long it's going to be before you have to start CPR on another dead body, rural EMTs get lots of "good calls".

In rural America, under favorable conditions, the amount of time from the inception of a critical trauma call until the patient arrives at a facility capable of emergency surgery is frequently over four hours. It is no wonder that when we hear the term, "The golden hour" *(the theoretical amount of time a critical trauma patient has before shock begins to cause irreversible damage),* rural EMTs often laugh. **In Hoopa EMS, we laughingly referred to the golden hour as "The golden half-day"***. (Even so, our "Limited Advanced Life Support" program did save many lives.)*

THE LIMITATIONS OF RURAL EMS:

- Discovery of the injured may take hours; therefore, notification is often delayed
- Long distance communications are often inadequate
- Neither 911 nor Emergency Medical Dispatch may exist
- First responder and mutual aid services are widely separated and not always completely staffed, equipped or trained
- Rural emergency services often have huge districts with resultant extended response and transport times
- Rural America has a greater percentage of BLS-only services than urban areas
- Weather, terrain, roadways, etc. may be hazardous and may interfere with EMS
- Contact and response of advanced air services depend on many and varied potential problem issues
- There are often inadequate numbers of rescuers and EMT's available at difficult scenes, back up ambulance support may be delayed or unavailable
- EMS may not have advanced life support capability on scene or may not be adequately trained or equipped to treat a critically injured child
- Unstable patients are usually transported to the nearest local facility that are often incapable of surgical intervention in life threatening shock syndrome
- Pediatric trauma patients require specialized care and equipment not always available at local emergency centers
- Trauma patients must often survive pre-surgical intervention times of over four hours
- After arrival at the local emergency facility, air-evac services must be notified, respond, land, make their way to the patient, load, and transport the patient many miles to surgery; this can easily create an additional two to three hour delay
- Fixed wing services require developed landing strips that are often remote from the hospital facility
- Not all air services are certified for pediatric trauma
- Definitive care and trauma centers are often great distances away
- Not all trauma centers are certified for pediatric trauma

XII. INJURY PREVENTION AFTER THE FACT: SPEEDING UP TRAUMA AND PEDIATRIC EMERGENCY CARE ON THE EMS FRONTIER

Reducing the amount of time before an operable trauma patient receives surgery is the primary purpose of regional trauma systems. Rural EMS programs can improve their ability to gain access to these systems in the following ways:

- Make sure that the EMS system is responding to critical trauma and pediatric trauma quickly, appropriately, and with the minimum of delay
- Assure that EMS resources are properly positioned in the district to provide the quickest possible response times to the majority of patients
- Assure that communications between all agencies are effective and cooperative
- Assure that local first responder agencies are responded immediately whenever an emergency call is received by the EMS program
- Identify and correct areas of the EMS district where communications dead spots exist.
- Identify and pre-designate areas where communications are the most reliable throughout the district and mark them on maps for the EMS units
- Coordinate, cooperate and train with local first responder agencies and hospital personnel, to provide the most efficient possible response to critical trauma
- Provide and train with all the appropriate pediatric equipment
- Assure that every EMT, especially Basic level EMTs, has the best possible pediatric emergency training that is appropriate to their skill level. (*For information on pediatric training and equipment go to **http://www.ems-c.org)***.
- Develop written protocols and clear guidelines between EMS and local medical control physicians that define procedures and requirements for activating trauma teams, pediatric specialists, and air-medical services in cases of critical and pediatric trauma
- Provide check off sheets for use by EMTs in the field that are acceptable and available to the medical control personnel at the base hospital. *(These can help in making the determination of need for surgical intervention quickly, without errors. An excellent resource for information on this subject is available in the Journal of Trauma article: **Karsteadt L, Larsen C, Farmer P. Analysis of a rural trauma program using the TRISS methodology: a 3-year retrospective study. Journal of Trauma. 1994;36:395 – 400)***
- Designate the types of patients who should bypass the local emergency facility and be transported immediately to the nearest trauma facility
- Develop memoranda of understanding with emergency air resources that assure the fastest possible response by them Establish pre-designated landing zones with pre-calculated and confirmed latitude and longitude designations throughout the EMS district. Make these available in every ambulance and every med-evac helicopter
- Develop procedures for the hospital personnel to assist the EMTs with coordination of Air-evac services
- Develop “John and Jane Doe” paperwork procedures to speed up patient intake and transfer procedures with fewer delays for identification of the patients

XIII. CHILD DEATH REVIEW TEAMS: A HIGHER LEVEL OF SURVEILLANCE

THE PURPOSE OF CHILD DEATH REVIEW TEAMS:
Many states now mandate regular meetings by county or regional multidisciplinary child death review teams. The purpose of these teams is to gather information, present findings and investigate unnatural deaths of children by unintentional injury, abuse, neglect, homicide, suicide and other questionable circumstances at monthly meetings. This information is then used to improve cooperation between the agencies responsible for the safety of children, to find lapses of communication between them that may lead to the preventable death of a child, to provide a forum for investigation of cases, and ultimately to find potential solutions to repeating patterns of unnatural childhood death. CDRTs have proven very valuable in reducing unnecessary deaths in children in many states. If you don't have one in your district, I urge you to get one started. It's an excellent forum to bring forward any environmental hazards that you uncover in your research. Information on CDRTs can be found at **http://child.cornell.edu/ncfr/home.html.**

MAKEUP OF THE TEAM:
A team leader is identified who is responsible to assign cases to the team each month. Cases are selected based on a preliminary review of each unnatural childhood death and on input from team members regarding any cases that they are personally concerned about.

Prior to the forming of the team, the team leader contacts representatives from the emergency community, fire, police, ambulance, hospital, nurses, physicians, injury prevention and mental health. Representatives from Child Protective Services and the coroner's office are essential, and a member of the community is also included. Other members can be included as deemed necessary and appropriate. A document is distributed outlining the laws pertaining to the team and the responsibilities of every member. A confidentiality statement is signed by each member and kept on file.

THE FIRST MEETING:
The first meeting of the team establishes the membership, the scheduling of meetings, what constitutes an unnatural death, and a review of the laws under which the team is established. There is usually considerable concern about legal responsibilities of the members and about the confidentiality laws that govern the team. These concerns are addressed and when everyone is satisfied with their roles and responsibilities, the team is formed. Alternates for some of the team members may be established at this time.

CASE REVIEW:
Cases that are to be brought for review are sent to each team member a week before the meeting in a confidential envelope. Each member gathers information pertinent to each case from his or her files as available. Copies of all the records pertaining to the cases are brought to the monthly meeting.

The case review begins with the team leader presenting an overview of the case, identity of the deceased, time and date of death, reported cause of death, and any relevant known facts. Then members of the team who have information briefly present their findings. A discussion follows the presentations.

The discussion centers on issues that should have warned the agencies involved that the child was endangered, failures to communicate those signals, inadequate follow up, and systems problems that may have prevented adequate protections for the child. Also investigated are any relevant facts that may lead to a reopening of the case by authorities and anything that may indicate a hazard in the community. Some teams also choose to investigate third-trimester fatalities.

The value of these multidisciplinary teams is that they bring together all of the protective community in order to investigate, document and correct any flaws in the system. By having members from each agency discussing these cases together in a non-threatening forum, many complications between agencies become known and can be addressed directly thus avoiding similar problems in the future. Also, by having access to all the facts at once, new information sometimes emerges that leads to effective injury prevention efforts. Yearly reports from the CDRT go to the County Board of Supervisors with recommendations for correcting issues that endanger children.

If your community does not have a CDRT in place, I urge you to go to the CDRT links in this document and gather information on the state and local requirements that pertain to your region. As a member of the Humboldt County CDRT at its inception in the early 1990's, I strongly believe that they are essential.

Our team found a number of serious policy issues that decreased cooperation and information sharing between public safety agencies. These issues were then easily and painlessly addressed by the team. This resulted in increased cooperation and improved communications. In addition some injury prevention issues came to light that would not otherwise have surfaced. In particular, the Coroner of that time advised the team that it's a common practice for coroners to avoid "suicide" as a cause of death, and also to use "SIDS" more frequently than necessary as a means of "protecting the families". If these practices are widespread, which seems likely, SIDS is being over reported and suicide under reported by an unknown but significant amount.

For protecting children, the two hours I spent at a regular lunch meeting of the Humboldt County CDRT was the most profitable time I spent each month. For an example of a working CDRT and the data that results go to the link below on the World Wide Web.

Child Deaths in California: 1992-1995

http://child.cornell.edu/ncfr/calif.html

The report was released in March 1997, and is appearing in electronic form for the first time. This report, approximately 25 pages in length, provides you with a concise overview of how a statewide commitment to child fatality review works. You can review the report to see how the findings of child death studies can be applied to prevention and intervention strategies with children, families, and service systems.

APPENDIX 1:
CASE STUDY:
WHO OR WHAT KILLED PRINCESS DIANA?
(LADY DIANA SPENCER)
TUNNEL VISION REVISITED

WHAT IS YOUR ANSWER TO THE ABOVE QUESTION?
Most people would probably say "Henri Paul" the drunken, speeding limo driver who was also on Prozac and Tiapridal. Both medications are potentiated by alcohol. There is also forensic evidence from two separate blood samples that showed Henri Paul's blood to contain almost 200 PPM of carbon monoxide. This in itself is a nearly lethal dose of the colorless odorless gas. There is no explanation for this blood result. The driver's brainstem was severed. He died instantly and so did not inhale any poisonous gas from the wreckage. He didn't smoke. He had a pilot's license physical approximately a week before with no unusual findings reported relating to his carboxyhemaglobin level or liver enzymes that indicated alcoholism. But, he was going very fast on that night in a semi-poisoned condition with alcohol and psychiatric medicine on board.

So, Henri Paul was at fault. On one level this is right of course. Perhaps if a sober driver had been at the wheel, they wouldn't have been going so fast. Perhaps his reflexes would have been better, and he could have avoided the loss of control that caused the car with Diana, her bodyguard and her fiancé to smash into a solid concrete pillar in the Pont de l'Alma Tunnel, perhaps. Or perhaps carbon monoxide was the principal problem. Henri Paul may well have passed out behind the wheel with that level of carbon monoxide in his system. Certainly a level of carbon monoxide high enough to make a healthy adult male pass out would be a level sufficient to cause him to lose control of his perceptions and his ability to control an automobile. Regardless of the reason, if we remove Henri Paul from the equation that night, Lady Diana might still be alive.

If we leave it at that, we get no farther in our understanding of the "accident," and driver error becomes a convenient and palatable reason for this unfortunate incident. It is a safe bet that the majority of the world sees it this way. But it is not the only way to see it. Making sure that all royal limousine drivers are always sober and medication free may protect the royal family, but it doesn't do a thing for the rest of the road users.

THE PONT D'ALMA TUNNEL:
On the day of the crash, from network TV coverage, it was immediately clear to me that the cement support pillars in the tunnel are a glaring, major hazard. They are very close to the edge of the left lane. They rest on a raised median, approximately three feet in width, bounded by a low sloping curb immediately adjacent to the traffic flow. The curb offers no protection at all from a vehicle coming in at an acute angle.

Looking at the crash site from different network camera angles shows that there are other pillars nearby that clearly bear the marks of other direct impacts, and there is also what appears to be old debris lying at the base of at least one of them.

The pillars themselves are massive, solid cement structures parallel to the road, and positioned close together. Any vehicle losing control to the left will be at severe risk of hurtling the low sloping curb and smashing directly into the corner of one of the pillars, as Diana's limo did. There is no barrier along the sides of the pillars to prevent the crash vehicle from coming to a sudden stop as Diana's did. Anyone who has seen the frontal impact tests that are put on yearly by the Insurance Institute for Highway Safety, knows the violence of a vehicle impacting a crushable

barrier at 40 miles per hour. Impacting a solid barrier at that speed is going to be very damaging to the vehicle and the occupants.

Although this unsafe situation leaped out at me, at the time there were no comments at all on the obvious hazardous design of the tunnel. Even the experts seemed focused on the driver, the speeding, the Mercedes S280 limousine itself, *("the safest car in the world", complete with "intelligent steering")* and the motorcycle paparazzi. The only comment on the tunnel came from a brief interview with Jackie Stewart, an ex Grand Prix race car driver, who stated that even he could not have negotiated the tunnel at the limo's reported speed of 100 miles per hour.

The roadway leading up to the tunnel is a two-lane, freeway type thoroughfare, with a probable speed limit of 30 to 50 miles per hour *(I could not find any report of the tunnel's actual speed limit)*. There is a long straight stretch (the "Cours la Reine", leading up to the tunnel. The tunnel begins at the bottom of a descending gradient with a slight dogleg to the left at the lip of the descent. From pictures of the tunnel approach gleaned on the web, the signage for the tunnel entrance is slightly below the level of the approach and appears difficult to see until a vehicle is in transit from grade to below grade.

There is a short and abrupt merge lane entrance from the "Cours Albert" on the right just before the descent. Any vehicle approaching the tunnel must avoid traffic merging suddenly from the right, negotiate a sudden descent, and make an off camber turn to the left at the same time. There was eyewitness testimony of a white Renault that suddenly merged from the right near the apex of the turn and there were white Renault "Uno" paint scuffs on the right side of the limousine that indicated a brushing sideswipe. A passenger side mirror from the Mercedes was found on the roadway near the lip of the descent into the tunnel. The mystery Renault was never found.

Lady Diana Spencer, Henri Paul-the driver, and Dodi Fayed were all unbelted. The only survivor was a belted front seat passenger *(Trevor Reese Jones)*, Diana's bodyguard. He survived the crash with major facial injuries from the violence of the deceleration and debris intrusion.

WOULD A SEAT BELT HAVE SAVED LADY DIANA?
Computer reconstruction of the skid marks, the dynamics of unbelted passengers flying forward and the impact kinetics estimates that the vehicle struck at between 70 and 100 miles per hour hurtling the unbelted passengers forward with an approximate G force of 70 times the force of gravity. A girl of Diana's build would sustain crushing forces against her chest of approximately 8-10,000 pounds as she smashed forward into the rear of the front seat chest first. It was this computer simulation of the crash that suggests to experts that if Lady Diana had been belted in, that she would have survived the crash *(See below)*.

COMPUTER SIMULATION OF THE CRASH AND THE KINETICS OF A BELTED VS. AN UNBELTED DIANA SPENCER:
Excerpts from:
Renfroe Engineering, Inc.
Accident Reconstruction
Computer Simulation of Lady Diana's Crash
http://www.renfroe.com/dianaanimation.html

"The acceleration that would have been experienced by the chest would have been about 70 times the force of gravity (70 g's), or about seven times what a fighter pilot experiences. The head would have experienced acceleration about 100 times the force of gravity.

Princess Diana experienced chest injuries, including a torn pulmonary artery that led to cardiac arrest.

"The chest acceleration is what causes the ... pulmonary artery to rip," said David Renfroe, a computer crash analyst. "Those kinds of accelerations of 70 g's will tear that." On the other hand, if a person in that

same position in the same accident is wearing a seat belt, the force hitting the head drops to 30 g's and the chest force to 35 g's."

LADY DIANA'S EMS CARE:
By ATLS standards the medical care Diana received from the EMS personnel was dismal at best. The Paris Fire Brigade was on scene within six minutes of the dispatch. Access to her was made through an undamaged rear passenger side door, clearly visible in the network news coverage. She was not pinned in any way. There was a physician on scene immediately who reported that she was conscious and moaning on his arrival. This indicates some brain perfusion and an unobstructed airway. It took 28 minutes to extricate her from the vehicle.

It took 66 minutes to transport Lady Diana to a hospital that was 10 miles away. The physician in the back of the ambulance reportedly ordered the driver keep the speed to 25 miles per hour to give her a "Smooth ride." The nearest Trauma Center designated for the royals, was five miles away. The treatment that Lady Diana received from the physician on scene and in the ambulance was defended by the French medical establishment as, "Stabilizing on scene".

THE OFFICIAL REPORT:

The following are excerpts from:

Final report by Paris prosecutor's office

Examining Magistrate:
Mr Hervé STEPHAN
Ms Christine DEVIDAL

COURT OF THE FIRST INSTANCE

Public Prosecutor of the French Republic

Dept.: P5 GENERAL CRIMINAL LAW
No. of entry: GG
No. of case: 97 245 3009/9
No. of preliminary investigation: 65/97

(D706 -D709)
At 0.26 hrs on August 31, 1997, the switchboard at Paris fire brigade headquarters received a code-18 emergency call informing them of a serious traffic accident in the Pont d'Alma tunnel in Paris's 8th arrondissement.

- The first Paris fire brigade crew arrived at the scene at 0.32 hrs.

- Lady Diana SPENCER, who had been sitting in the rear right passenger seat, was still conscious and crouched on the floor of the vehicle with her back to the road.

- At her side, stretched out on the rear seat, was Emad AL FAYED, who had been sitting in the rear left passenger seat and appeared to be dead. Nevertheless, fire officers were still trying - in vain - to resuscitate him when he was pronounced dead by a doctor at 1.30hrs.

- In the front of the vehicle was the driver, Henri PAUL, the deputy security manager at the Ritz hotel, who had been killed immediately and was declared dead on removal from the wreckage.

- The front passenger was Trevor REES JONES, a body guard in the employment of the Al FAYED family, who was still conscious and had suffered serious multiple injuries to the face.

The two forward passengers' airbags had functioned normally.

(D789 - D6858)
Autopsy examination concluded that Henri PAUL and Emad AL FAYED had both suffered a rupture in the isthmus of the aorta and a fractured spine, with, in the case of Henri PAUL, a medullar section in the dorsal region and in the case of Emad AL FAYED a medullar section in the cervical region.

(D6833 - D6821)
Lady Diana Spencer received pre-hospital intensive care treatment, both while she was trapped in the wreckage, from which she was finally released at 1am, and during her transfer by ambulance, until her arrival at Pitie Salpetriere hospital at 2.06hrs.

The report submitted by professors Dominique LECOMTE and Andre LIENHART concluded that the cause of death was a wound to the upper left pulmonary vein, together with a rupture to the pericardium. The experts stated that, resuscitation had been in accordance with "pre-hospitalisation regulations". "The surgical team was beyond reproach, and no other surgical, anaesthetic or resuscitation strategy could have prevented deterioration in the condition of the patient."

CONCLUSION: WHAT DID KILL LADY DIANA SPENCER?
As is the case with most fatal traumatic events, a series of mistakes and complications killed her. A sober driver, a vehicle traveling at a safe speed, a safety belt and quicker EMS transport to a trauma center could all have saved her, perhaps. However, when looking at the total picture, the tunnel itself plays the biggest part. Subsequent investigation indicates that 13 people had been killed in the Pont d'Alma tunnel during the preceding decade. Even in a high traffic area that is excessive.

Marks on adjacent columns clearly show that previous impacts have taken place. Because they are so close to the traffic lane and there is only a low sloping curb with a narrow median between the vehicles and the columns, any minor collision in the tunnel can easily result in a vehicle careening over the curb and into the pillars with deadly force. Ironically, on further review of pictures, you can see small sections of the tunnel that have guardrail protection. Apparently the hazard of the columns was recognized at these locations, but for some reason, they were not applied to all the pillars. Perhaps there is a trigger mechanism for safety related improvements that had not yet been reached at the site of Lady Diana Spencer's fatal crash. This is a common practice in the United States, i.e. "We don't make safety improvements on a roadway site until there have been (*x number of*) deaths there." *(The movie "Ronin" has a chase scene that goes through the Pont d'Alma tunnel against traffic. If you want an interesting look at the tunnel and at a lot of streets in France that are an injury prevention professional's nightmare, I strongly recommend watching it.)*

AN EASY AND CHEAP ENVIRONMENTAL SOLUTION:
SEPARATE THE TRAFFIC FROM THE HAZARD WITH A BARRIER

The obvious solution to protect not only royalty, but also all the roadway users at this cluster site, is to place a barrier between the traffic and the columns themselves that will keep all vehicles from impacting the fixed object head on. This will result in a more glancing blow that dissipates the energy more slowly instead of transferring it directly to the passengers. There will be no reduction in the incidence of collisions in the tunnel, but there will be a large reduction in lethality. *(DS 2002)*

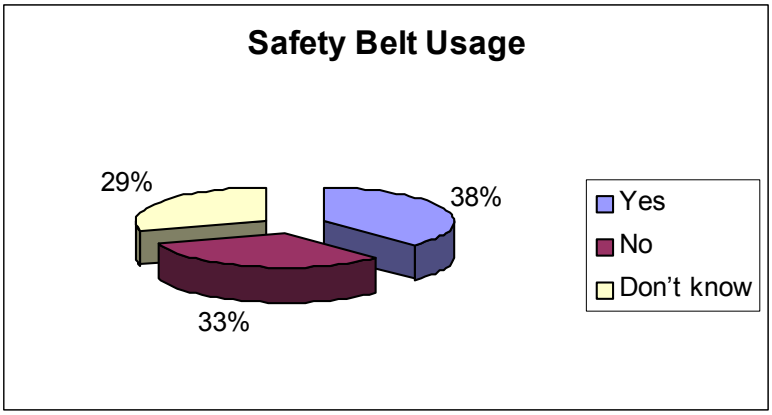
APPENDIX 2.

NEW STUDY OF PATTERNS OF DEATH IN THE UNITED STATES

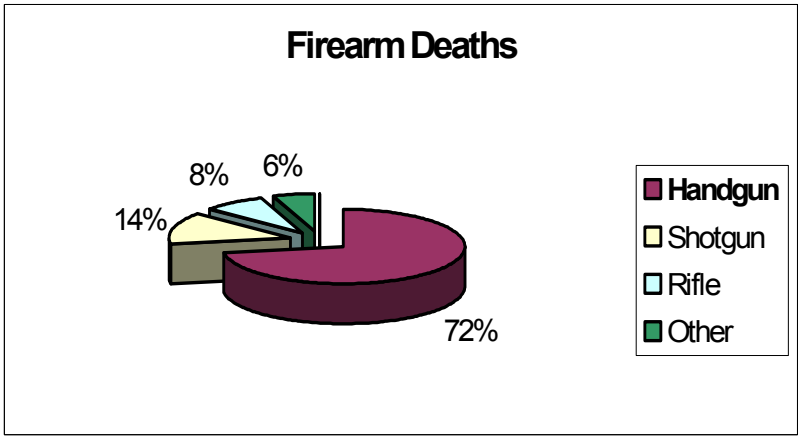
http://www.cdc.gov/nchs/releases/98facts/93nmfs.htm

NOTE: *The next four charts were developed by the author using data tables from the web page above. In all four charts, the data excludes deaths to persons under 15 years of age and those deaths occurring in South Dakota. Standard errors are estimated using the statistical software package SUDAAN.*

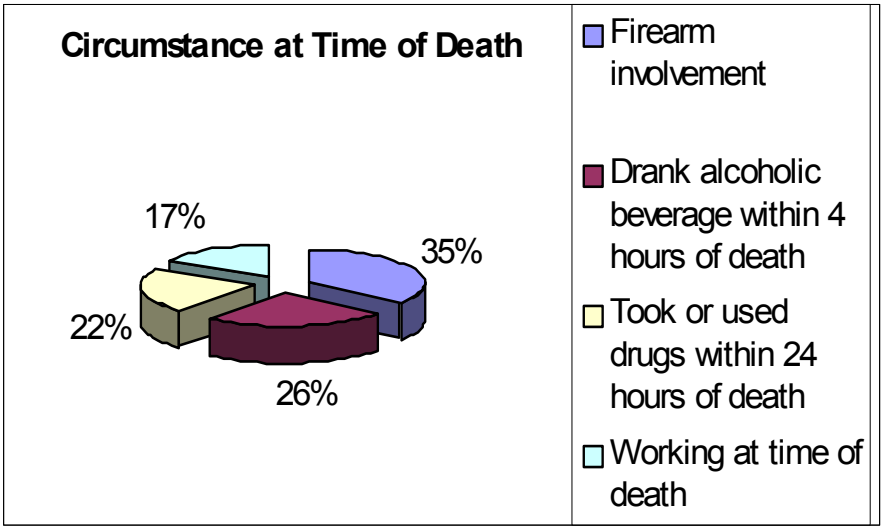
1. Number and percent distribution of decedents who died of motor vehicle injuries by selected circumstances as reported by proxy respondents:
United States, 1993
SOURCE: NCHS, National Mortality Followback Survey -- provisional data, 1993.



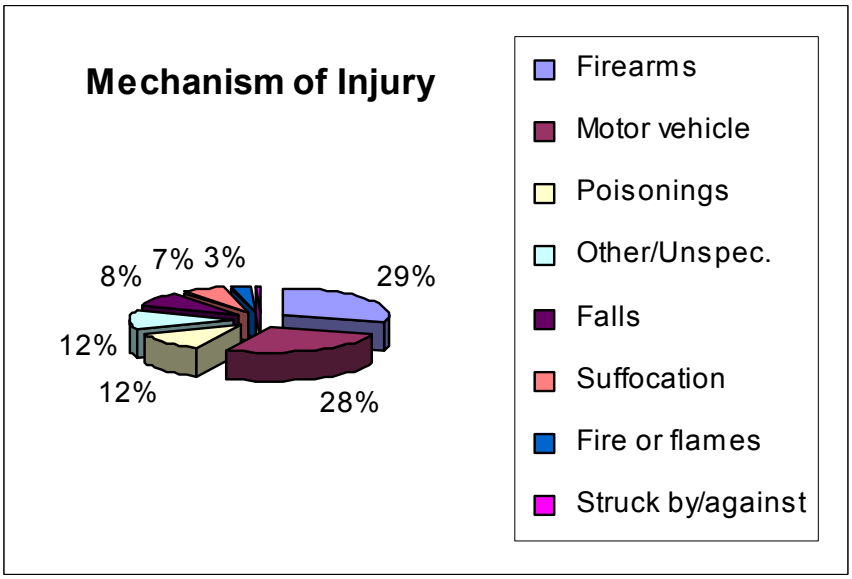
2. Percent distribution of decedents dying of external causes (homicide, suicide, accidental injury) where firearms were reported by proxy respondents to have been involved by type of firearm:
United States, 1993
SOURCE: NCHS, National Mortality Followback Survey -- provisional data, 1993.



3. Percent of decedents dying of external causes (homicide, suicide, accidental injury) by selected circumstances as report by proxy respondents:
United States, 1993
Source: NCHS, National Mortality Followback Survey -- provisional data, 1993.



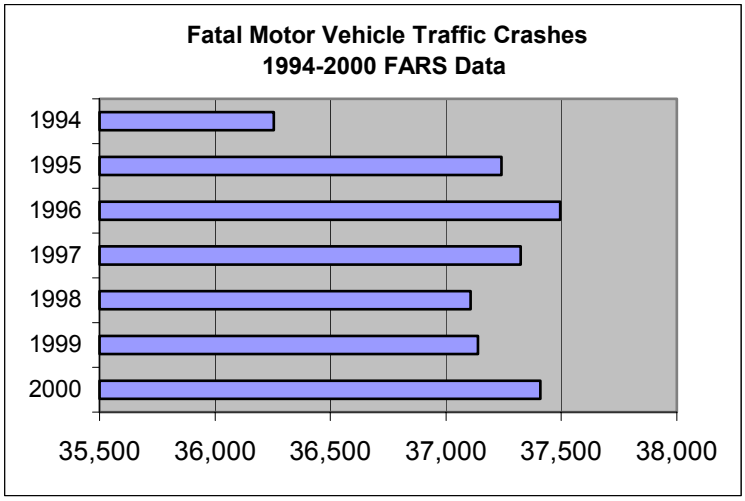
4. Percent distribution of decedents dying from external (E-coded) underlying cause by mechanism of injury:
United States, 1993
Source: NCHS, National Mortality Followback Survey--provisional data, 1993.



APPENDIX 3:

FATALITIES IN MOTOR VEHICLE CRASHES and SAFETY BELT USE

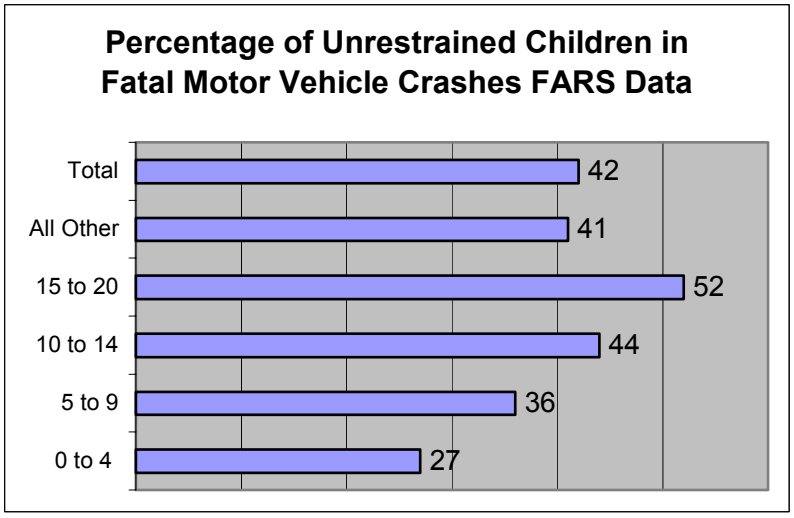
NOTE: *The following two charts were developed by the author using information from data tables at the following web address:*
http://www-fars.nhtsa.dot.gov/



"Regardless of crash severity, the majority of vehicles in single- and two-vehicle crashes were going straight prior to the crash. The next most common vehicle maneuver differed by crash severity: negotiating a curve for fatal crashes, turning left for injury crashes, and stopped in traffic lane for property-damage-only crashes."
[Vehicles ; 1999]
FARS Traffic Safety Facts--2000

"Compared with other vehicle types, utility vehicles experienced the highest rollover rates: 37.8 percent in fatal crashes, 10.0 percent in injury crashes, and 2.5 percent in property-damage-only crashes."
[Vehicles ; 1999]
FARS Traffic Safety Facts—2000

"The proportion of vehicles that rolled over in fatal crashes (19.7 percent) was more than 4 times as high as the proportion in injury crashes (4.7 percent) and more than 16 times as high as the proportion in property-damage-only crashes (1.2 percent)."
[Vehicles ; 1999]
FARS Traffic Safety Facts--2000



"All states, the District of Columbia, and Puerto Rico have laws requiring children of certain ages to be restrained in child safety seats".
[States; 1999]
FARS Traffic Safety Facts--2000

"In 1998, there were 575 occupant fatalities among children under 5 years of age. Of those 575 fatalities, an estimated 293 (51 percent) were totally unrestrained".
[Children; 1998]
FARS Traffic Safety Facts--2000

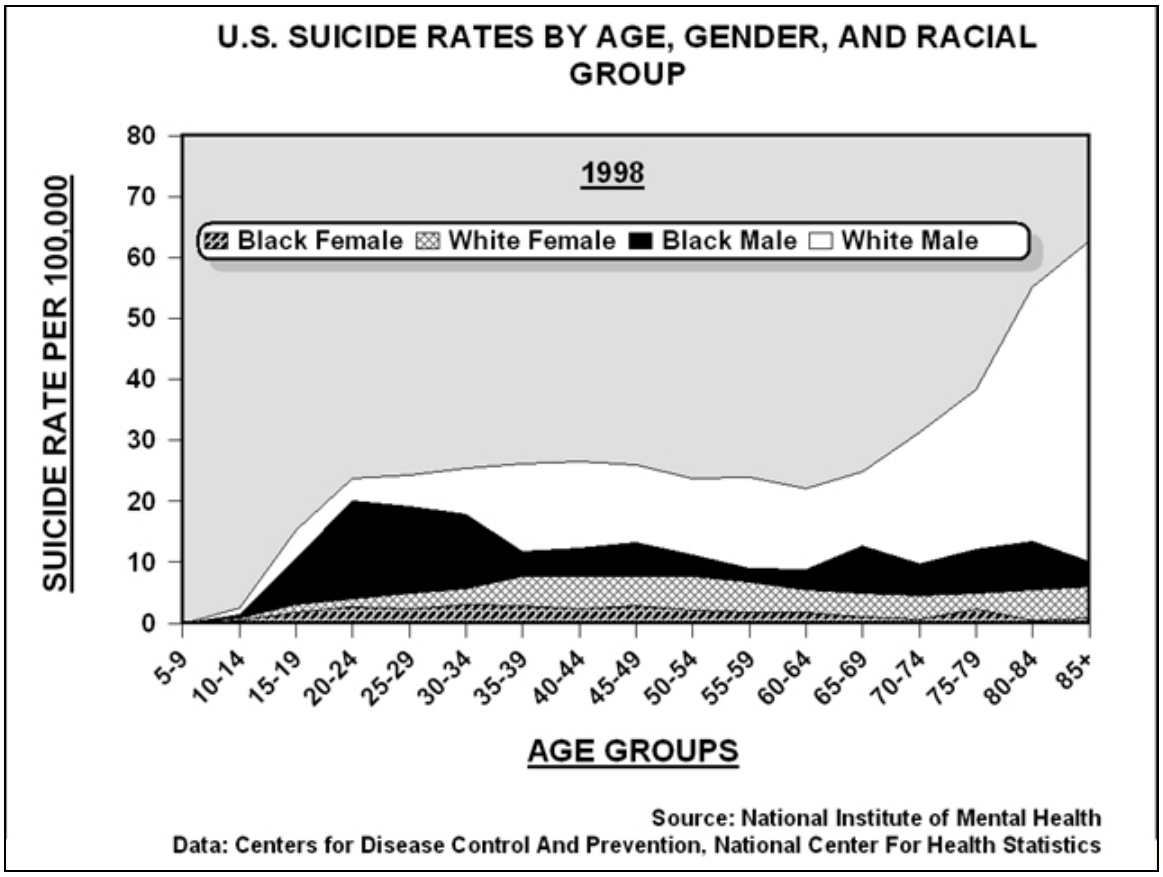
"Research on the effectiveness of child safety seats has found them to reduce fatal injury by 71 percent for infants (less than 1 year old) and by 54 percent for toddlers (1-4 years old) in passenger cars. For infants and toddlers in light trucks, the corresponding reductions are 58 percent and 59 percent, respectively."
[Children; 1998]
FARS Traffic Safety Facts—2000

"In 1999, it is estimated that 307 children under age 5 were saved as a result of child restraint use. An estimated 4,500 lives were saved by child restraints from 1975 through 1999." *[Restraint systems; 1999]*
FARS Traffic Safety Facts--2000

APPENDIX 4.

NATIONAL INSTITUTES OF HEALTH

http://www.nimh.nih.gov/research/suichart.htm



(Note: This page was reproduced from the NIH Web site cited above.)

APPENDIX 5.

EMS, EMSC AND INJURY PREVENTION RESOURCES

The advent of the computer and the Internet Age has brought literally thousands of resources directly to people's homes via computers and the World Wide Web. Global search programs such as http://www.dogpile.com/ and hyperlinks that take you directly to documents of interest have made "Surfing the web" simple, interesting, fun and very productive. Below are some working examples of free information available on the web for EMTs and other Injury prevention researchers. If you are viewing this document on the WWW, just click on the blue hyperlinks to go straight to the topics that are listed along with the links. Information wants to be free; go get some. Happy surfing! If you are not currently using the Internet for communications and to obtain information, I urge you to try it as soon as possible. There are endless free resources out there for you.

Emergency Medical Services For Children.org

http://www.ems-c.org/index.htm

EMSC is a national initiative designed to reduce child and youth disability and death due to severe illness or injury. Its goals are to ensure that state-of-the-art emergency medical care is available for all ill or injured children and adolescents; that pediatric services are well integrated into an emergency medical services (EMS) system; and that the entire spectrum of emergency services, including primary prevention of illness and injury, acute care, and rehabilitation, are provided to children and adolescents. A federal grant program supports state and local action.

EMSC Five-year Plan: 2001-2005

http://www.ems-c.org/products/frameproducts.htm

Abstract:

This publication establishes the goals and objectives for the EMSC Program for the years 2000 through 2005. Each goal is displayed in table format and includes a set of objectives, activities to accomplish each objective, mechanisms needed to reach each activity, and a time line. A list of national organizations that are potential participants in the implementation process is also included as well as baseline data where available. Single copies are provided free of charge.

Pediatric Emergency Care Course (PECC)

http://www.ems-c.org/products/frameproducts.htm

Abstract:

Containing the 2000 American Heart Association (AHA) guidelines for CPR, this revised curriculum offers a new approach to pediatric assessment, resuscitation, and treatment education. It should be used with AHA's Pediatric Advanced Life Support Course.

The American Trauma Society

http://www.amtrauma.org/links/

(Links page. An excellent resource, and all the links worked.)

EMS Agenda for the Future

http://www.nhtsa.dot.gov/people/injury/ems/agenda/

The Vision:

Emergency medical services (EMS) of the future will be community-based health management that is fully integrated with the overall health care system. It will have the ability to identify and modify illness and injury risks, provide acute illness and injury care and follow-up, and contribute to treatment of chronic conditions and community health monitoring. This new entity will be developed from redistribution of existing health care resources and will be integrated with other health care providers and public health and public safety agencies. It will improve community health and result in more appropriate use of acute health care resources. EMS will remain the public's emergency medical safety net.

To realize this vision, continued development of 14 EMS attributes is required. They are:

- Integration of Health Services
- EMS Research
- Legislation and Regulation
- System Finance
- Human Resources
- Medical Direction
- Education Systems
- Public Education
- Prevention
- Public Access
- Communication Systems
- Clinical Care
- Information Systems
- Evaluation

U.S. Department of Transportation
National Highway Traffic Safety Administration
http://www.nhtsa.dot.gov/
Information on youth safety is available from the National Center for Statistics and Analysis, NRD-31,400 Seventh Street, S.W., Washington, D.C. 20590. NCSA information can also be obtained by telephone or by fax-on-demand at 1-800-934-8517. FAX messages should be sent to (202) 366-7078. Internet users at can access general information on highway traffic safety:
http://www.nhtsa.dot.gov/people/ncsa.
To report a safety-related problem or to inquire about motor vehicle safety information, contact the Auto Safety Hotline at 1-800-424-9393.

NHTSA: Trauma Vision Document Part 1 of 2
http://www.amtrauma.org/view.cfm?whatsnew_id=43
The Vision: Trauma systems of the future will enhance community health through an organized system of injury prevention, acute care and rehabilitation which is fully integrated with the public health system in a community. Trauma systems will not only possess the distinct ability to identify risk factors and related interventions to prevent injuries in a community, but will also clearly maximize the delivery of optimal resources for patients who ultimately need trauma care. The resources required for each component of a trauma system will be clearly identified and studied to ensure that all injured patients gain access to the appropriate level of care in a coordinated and cost-effective manner.

NHTSA: Trauma Vision Document Part 2 of 2
http://www.amtrauma.org/view.cfm?whatsnew_id=44

NCSA: National Center for Statistics and Analysis
http://www.nhtsa.dot.gov/people/ncsa/factshet.html
NCSA is responsible for providing a wide range of analytical and statistical support to NHTSA and the traffic safety community, through data collection, analysis, and crash investigation activities.

Fatality information is derived from the Fatality Analysis Reporting System (FARS). FARS includes motor vehicle traffic crashes that result in fatality to a vehicle occupant or nonmotorist, from injuries resulting from a traffic crash, that occur within 30 days of the crash.

ICAN/National Center on Child Fatality
http://child.cornell.edu/ncfr/home.html#ncfr
ICAN/National Center on Child Fatality Review Mission Statement:
The mission of the ICAN/National Center on Child Fatality Review (ICAN/NCFR) is to prevent severe and fatal trauma, abuse and neglect of children.
The mission of the ICAN/NCFR will be carried out through the establishment, support and expansion of a national network of multi-agency, multi-disciplinary, local, regional and state **Child Fatality Review Teams**.

The Injury Prevention Web

http://www.injurypreventionweb.org/

The Injury Prevention Web hosts the web sites of several agencies and organizations working to prevent injuries. This site contains a weekly literature update of recent journal articles and agency reports, injury data for every U.S. state, more than 1400 links to government and non-profit injury prevention sites worldwide, suggestions of books for your library, the gateway for information about scheduled NIITS teleconference sessions, and listings of jobs in the injury research and prevention field.

Children's Safety Network

http://www.edc.org/HHD/csn/

CSN is primarily supported by the U.S. Department of Health and Human Services' Health Resources and Services Administration.

American Association of Suicidology

http://www.suicidology.org/index.html

U.S.A. SUICIDE: 1999 OFFICIAL FINAL DATA

The American Association of Suicidology, a nonprofit organization dedicated to the understanding and prevention of suicide. This site is designed as a resource for anyone concerned about suicide, including AAS members, suicide researchers, therapists, prevention specialists, survivors of suicide, and people who are themselves in crisis.

The Foundation for Spinal Cord Injury Prevention, Care & Cure

http://www.fscip.org/

The Foundation for Spinal Cord Injury Prevention, Care & Cure (FSCIPCC) is a non-profit educational group dedicated to the prevention, care and cure of spinal cord injuries through public awareness, education and funding research. Founded by its current Chairman Ronald R. Gilbert, FSCIPCC is committed to improving the quality of care for persons with serious spinal cord injuries and to raising funds that support the search for a cure.

FSCIPCC is comprised of victims of spinal cord injuries and their families, persons dedicated to the prevention, care and cure of SCI and professionals who provide free counsel to SCI victims.

The FSCIPCC provides SCI victims with information about: the facts of spinal cord injuries; prevention of SCI injuries; care of SCI victims; ongoing SCI research for a cure; financing and managing disability-related expenses; liability, compensation and your rights; legal options available; and accessing professionals and organizations that will provide free help and counsel.

VINCENTweb!

Violence and Injury Control through
Education, Networking and Training
on the World Wide Web

http://www.sph.unc.edu/vincentweb/

Sponsored by:
The Injury Prevention Research Center at the University of North Carolina at Chapel Hill
Free introductory course on injury prevention and control contains material from the June 6, 1997 videoconference, "Getting Started in Injury Control and Violence Prevention" presented in a web-based format that expands upon and supplements the televised program.

Insurance Institute for Highway Safety

http://www.hwysafety.org/

The Insurance Institute for Highway Safety and the Highway Loss Data Institute are independent, nonprofit, research and communications organizations funded by auto insurers and dedicated to reducing highway crash deaths, injuries, and property losses.

STATUS REPORT SPECIAL ISSUE: DRIVER DEATH RATES

http://www.hwysafety.org/sr_ddr/sr3507_detail.htm

Driver fatality rates: Vehicles in model years 1994-97, for driver fatalities
(Death rates for vehicles in model years 1994-1997. Very useful table.)

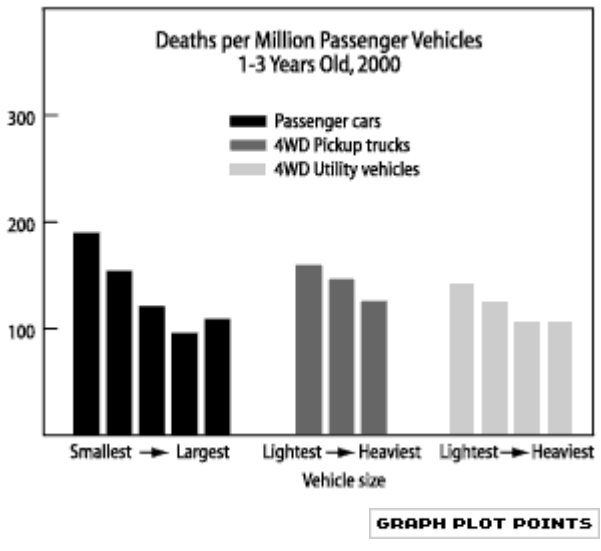
FATALITY FACTS: PASSENGER VEHICLES

as of October 2001 *(Note: The graphic below was reproduced from the following web site)*

http://www.hwysafety.org/safety%5Ffacts/fatality%5Ffacts/passveh.htm#

FATALITY FACTS: PASSENGER VEHICLES
as of October 2001
PDF of this document

By far the largest number of motor vehicle deaths are occupants of passenger vehicles including cars, the popular passenger vans often referred to as minivans, pickups, utility vehicles, and cargo/large passenger vans. The likelihood of crash death varies markedly among these vehicle types according to size. Small/light vehicles have less structure and size to absorb crash energy, so more injurious forces can reach their occupants in crashes. People in lighter vehicles are at a disadvantage in collisions with heavier vehicles. Pickups and utility vehicles are proportionally more likely than cars to be in fatal single-vehicle crashes, especially rollovers. However, pickups and utility vehicles generally are heavier than cars, so occupant deaths are less likely to occur in multiple-vehicle crashes.



National Association of State EMS Medical Directors

http://www.nasemsd.org/

NASEMSD MISSION: "Providing leadership and support to develop effective EMS systems throughout the nation and formulate national EMS policy, and to foster communication and sharing among state EMS directors."

Challenges of Rural Emergency Medical Services

http://www.nasemsd.org/rural_emergency_medical_servic.html

Opinion Survey of State EMS Directors
June 22, 2000

Table 1: Coverage by Population and Geography

	Coverage Statewide Population	Coverage Rural Population	Coverage Statewide Geography	Coverage Rural Geography
EMT	88.29%	88.00%	90.36%	90.03%
EMT-Paramedic	72.77%	47.33%	55.62%	46.35%
Appropriate Medical Oversight	76.56%	69.26%	71.77%	66.56%
911	79.67%	76.67%	79.57%	77.60%
Enhanced (911)	81.86%	67.20%	73.06%	68.76%
Emergency Medical Dispatch (EMD)	54.85%	39.57%	47.93%	41.93%
QI or QA for EMS Providers	64.26%	55.70%	60.32%	54.48%

(Note: This table was reproduced from the Web site cited above.)

Trauma Watch

A News Publication for the Trauma Care Community
By the American Trauma Society
http://208.58.30.127/TRAUMA%20WATCH/
Trauma Watch, a news publication for the trauma care community. This new biweekly publication is a product of the Trauma Information Exchange Program (TIEP), a CDC-funded program of the American Trauma Society in collaboration with the Johns Hopkins Center for Injury Research and Policy.

The mission of TIEP is to foster the use and exchange of information by trauma institutions to improve trauma care. TIEP will maintain a Trauma Center Inventory in a secure, password-protected website, to include all trauma centers in the U.S. designated by a legally authorized agency within a state or verified by the American College of Surgeons. Our goal is that this private TIEP website will become a vehicle for communication and information sharing among trauma centers. Future TIEP plans include the addition of trauma system data to the Inventory and development of a Trauma Care Status Report that can be updated on a regular basis.

In the meantime, be sure to check back every two weeks for the latest issue of Trauma Watch.

Safetyforum.com

http://www.safetyforum.com/cgi-bin/sn_search.cgi?ID=002855
On January 28, 2002, Goodyear announced a replacement program in a letter to the NHTSA, but denied that the tires being replaced were defective. The letter advised that **Goodyear would replace for free some of its earlier design LT245/75R16 and LT235/85R15 Load Range E tires**, which were sold under various brand names, with its latest design brand Load Range E tires, but noted that the replacement program is limited to tires on only a few vehicles.

Goodyear's program is confined to cover tires on 15 passenger vans and ambulances. Other registered owners of LT235/85R15 tires will not even receive notification letters, in spite of reports of fatalities and serious injuries in other vehicles such as pick-up trucks and vans that are not 15 passenger vans.

Ford Explorers Roll Over 4 Times More Often Than Other SUV's When Tires Fail

http://www.safetyforum.com/news/010521.html
The analysis of NHTSA's database focused on 3,533 reports that identify the make and model of the vehicle on which Firestone tires failed. The analysis reveals that 2,450 tire failures on Ford Explorers produced 306 rollovers, a rollover-to-tire-failure rate of 13 percent. Other Ford SUV's and light trucks had a rollover-to-tire-failure rate of 5 percent (507 failures produced 24 rollovers). All other SUV's and light trucks had a rollover-to-tire-failure rate of only 3 percent (416 failures produced 12 rollovers). All other vehicles, primarily automobiles, had a rollover-to-tire-failure rate of 2 percent (160 failures produced four rollovers).

APPENDIX 6.

BIOTERRORISM INFORMATION

National Emergency Management Association

http://www.nemaweb.org/Trends_in_Terrorism_Preparedness/index.htm

NEMA represents the emergency management directors in the 50 states, territories and District of Columbia who are responsible to their governors for disaster preparedness, including acts of terrorism. In October 2001, NEMA conducted a survey of states to identify trends in state terrorism preparedness – activities taking place both prior to and following the terrorist attacks that took place on September 11, 2001. Thirty-nine states responded to the survey. Partial data for other states was collected through public resources such as web pages, news clippings and in some cases, personal phone interviews.

CDC Bio-terrorism Web Site

www.bt.cdc.gov.

Information Networks and Other Information Sources

http://www.cdc.gov/other.htm#states

(Excellent links page)

MMWR

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5041a2.htm

October 19, 2001 / 50(41);893-7

Recognition of Illness Associated with the Intentional Release of a Biologic Agent

Health-care providers should be alert to illness patterns and diagnostic clues that might indicate an unusual infectious disease outbreak associated with intentional release of a biologic agent and should report any clusters or findings to their local or state health department.

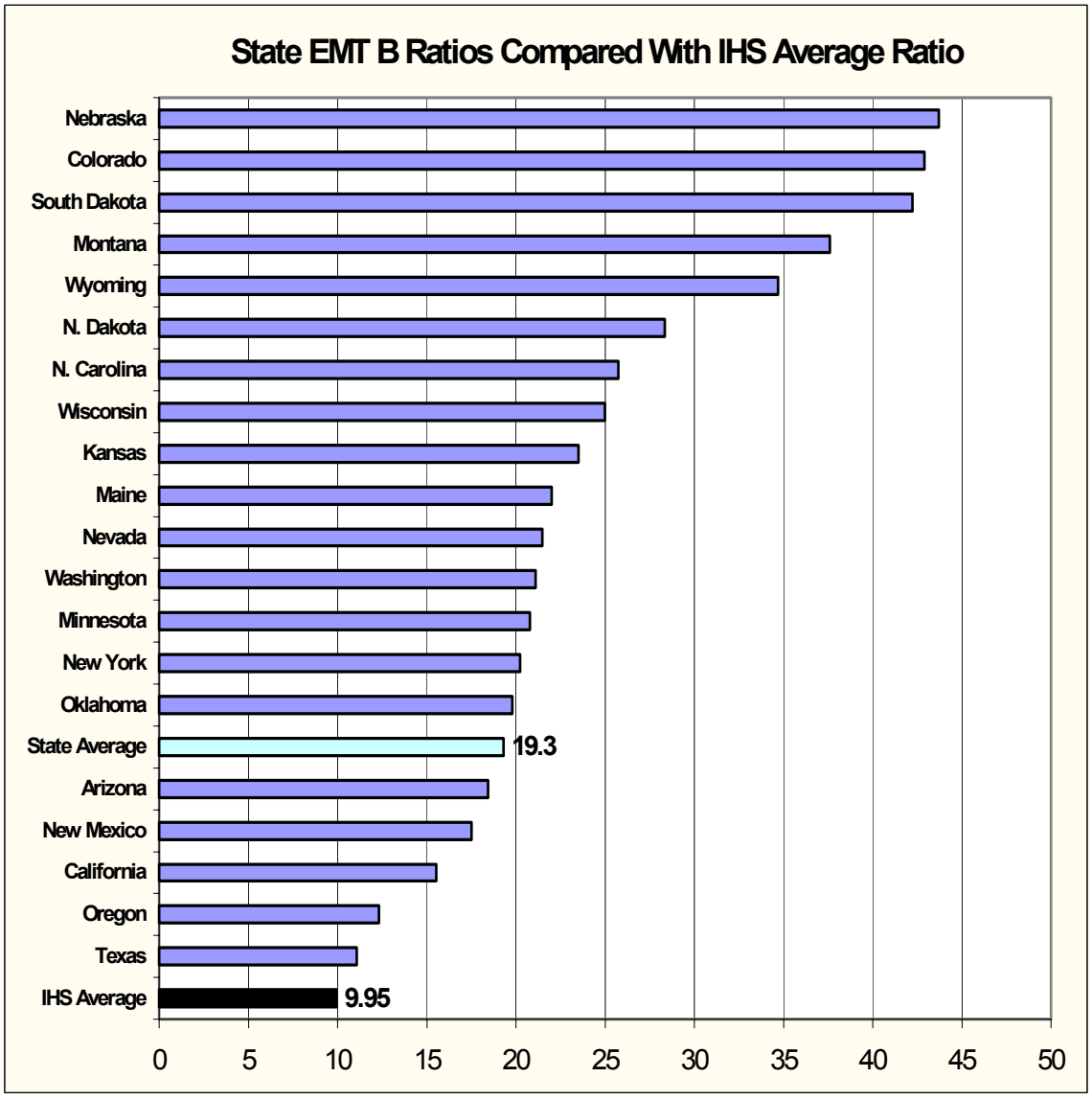
Additional information about responding to bioterrorism is available from CDC at <http://www.bt.cdc.gov>; the U.S. Army Medical Research Institute of Infectious Diseases at <http://www.usamriid.army.mil/education/bluebook.html>; the Association for Infection Control Practitioners at <http://www.apic.org>; and the Johns Hopkins Center for Civilian Biodefense at <http://www.hopkins-biodefense.org>.

The U.S. Army Medical Research Institute of Infectious Diseases USAMRIID's MEDICAL MANAGEMENT OF BIOLOGICAL CASUALTIES HANDBOOK

Fourth Edition February 2001

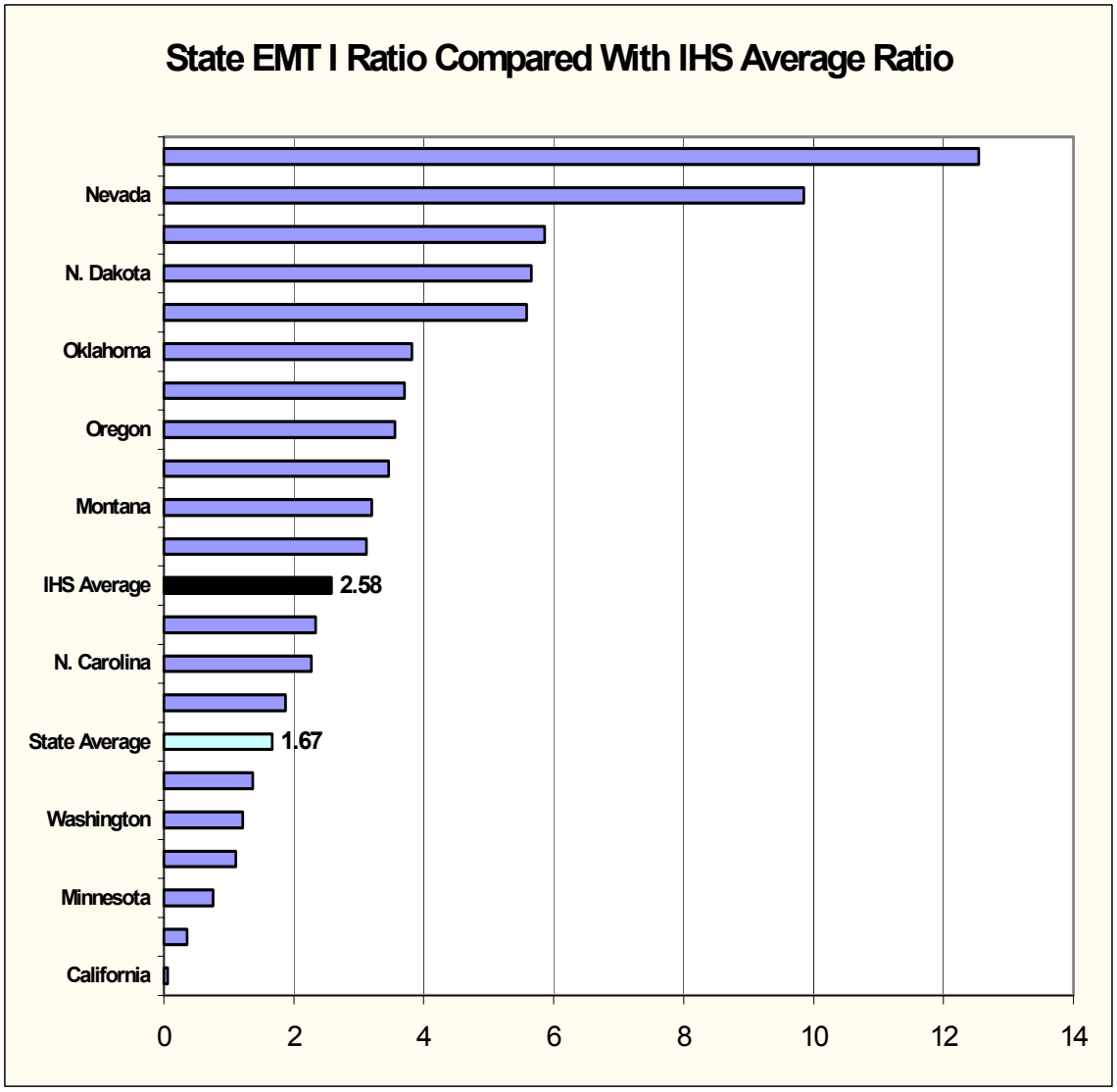
http://www.usamriid.army.mil/education/bluebook.html

APPENDIX 7.
STATE EMT B RATIOS PER 100,000 POPULATION

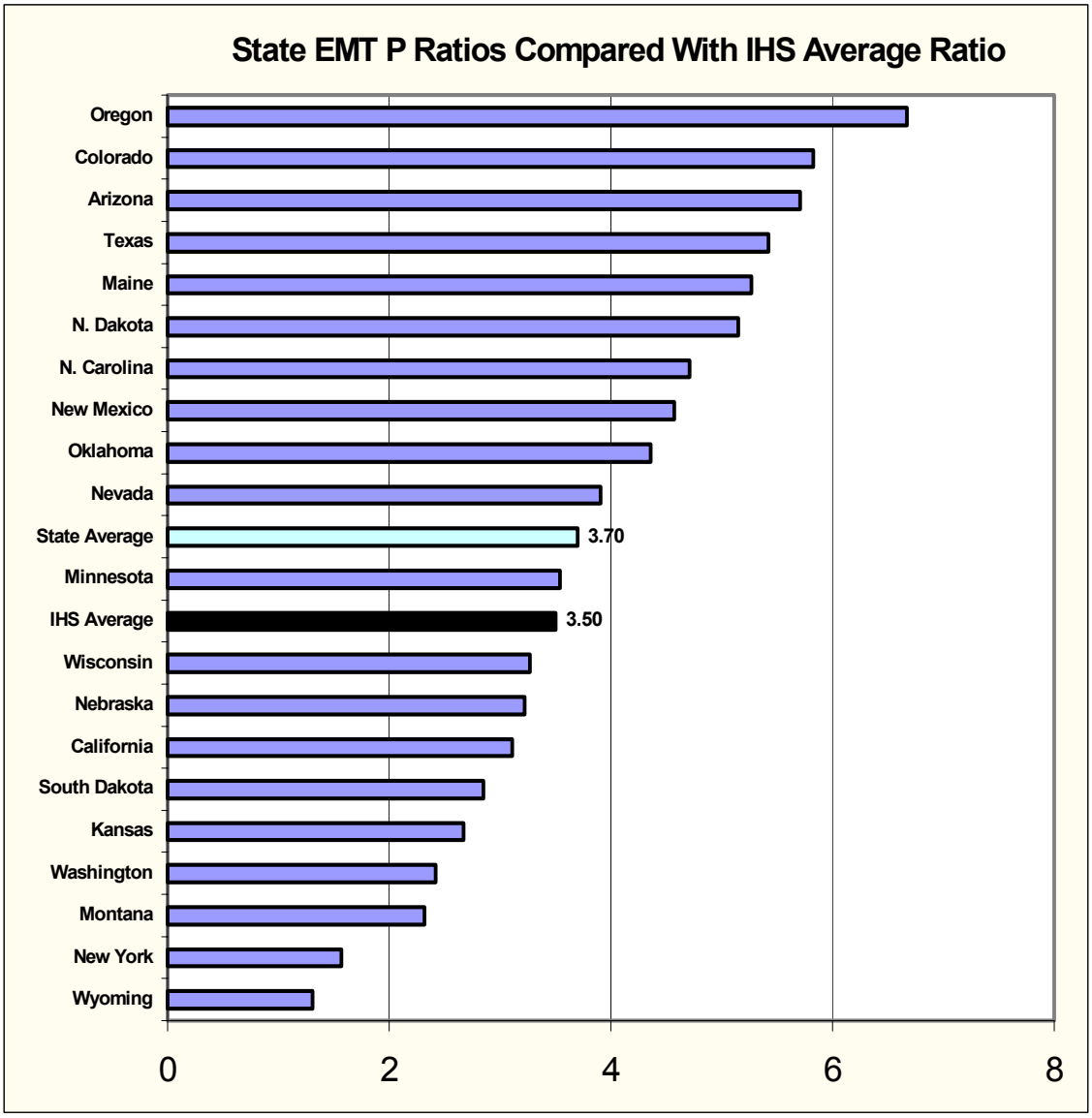


APPENDIX 8.

STATE EMT INTERMEDIATE RATIOS PER 100,000 POPULATION



APPENDIX 9.
STATE EMT PARAMEDIC RATIOS PER 100,000 POPULATION



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Doc Holliday Sr. to the author while working on an automobile approximately 1965. I asked "Will it work?" He replied, "With luck, and God's grace in a long handled spoon"

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Linda Ford, Former of Cherokee EMS, and Former President of the National Native American EMS Association "We do injury prevention, but we don't do what you do."

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July 2, 2001
http://156.40.88.3/new/releases/drowning.cfm
National Study Examines Sites Where U.S. Children Drown
Ruth Brenner, M.D., M.P.H. et al.

"Although drunk driving is a crime and stupid as well, the offender should not suffer the death penalty as a result of their stupidity when it is preventable." *(Thanks to Leon Robertson for arguing this case with me back in 1983. It was this argument that changed my viewpoint permanently).*

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